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SELECTED  
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RESOURCES  
ABSTRACTS



VOLUME 9, NUMBER 15  
AUGUST 1, 1976

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# **SELECTED WATER RESOURCES ABSTRACTS**

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology,  
U.S. Department of the Interior



**VOLUME 9, NUMBER 15**  
AUGUST 1, 1976

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The Secretary of the U.S. Department of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Depart-

ment. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1978.

**A**s the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

# FOREWORD

**S**elected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus**. Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

**Selected Water Resources Abstracts** is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by co-ordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstract-

ing, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center  
Office of Water Research and Technology  
U.S. Department of the Interior  
Washington, DC 20240

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### 01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions

### 02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

### 03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

### 04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

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Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

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## ABSTRACT SOURCES

# SELECTED WATER RESOURCES ABSTRACTS

## 2. WATER CYCLE

### 2A. General

**INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 2H.  
W76-07563

**WATER MOVEMENT THROUGH SATURATED-UNSATURATED POROUS MEDIA: A FINITE-ELEMENT GALERKIN MODEL,**  
Oak Ridge National Lab., Tenn.  
For primary bibliographic entry see Field 2F.  
W76-07569

**DIGITAL MODEL OF THE GRAVEL AQUIFER, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2F.  
W76-07593

**RUNOFF STUDIES ON SMALL WATERSHEDS,**  
West Virginia Univ., Morgantown. Water Research Inst.  
J. C. Burchinal.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 933, \$3.50 in paper copy, \$2.25 in microfiche. Information Report 4, (WRI-WVU-76-02) 1976, 12 p, 2 ref. OWRT A-003-WVA(4). 14-01-0001-1417.

**Descriptors:** \*Evapotranspiration, \*Model Studies, \*Peak discharge, \*Small watersheds, \*Storm runoff, Agricultural runoff, Agricultural watersheds, \*Demonstration watersheds, Hydrology, Methodology, Rainfall, Rainfall-runoff relationships, Runoff, Surface runoff, \*West Virginia.

Three small experimental watersheds were constructed in 1966. The watersheds cover about 10, 15, and 46 acres, and none contained a stream. Long-term data collection and a series of basic studies on this size watershed began. This report chiefly covers the results of two of these studies - (1) model selection for frequency analysis of runoff data and (2) evapotranspiration as a function of meteorological conditions and soil water. The model of Gumbel proved to be the most preferred and that of Gringorten the least. Adaptations were made for small watersheds in West Virginia. Relationships between actual evapotranspiration, potential evapotranspiration, soil moisture, available water, net radiation, pan evaporation, and other factors were established for the watersheds. Ninety-two percent of the variation in actual evapotranspiration could be accounted for by using potential evapotranspiration and available water as the independent variables in a multiple regression equation, giving a standard error of 0.11 inches. The methodology was specially adapted to analysis of very small watersheds in West Virginia. (Dodson-West Virginia)  
W76-07673

**PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS,**  
Arizona Univ. Tucson. School of Renewable Natural Resources.  
W. Hanes.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-252 858, \$5.00 in paper copy, \$2.25 in microfiche. M. S. Thesis, 1975. 83 p, 17 fig, 8 tab, 32 ref, 3 append. OWRT B-032-ARIZ.(22) 14-31-0001-3858.

**Descriptors:** Watershed management, \*Decision making, \*Water yield, \*Snowmelt, \*Model studies, Forecasting, Stochastic processes, Synthetic hydrology, \*Runoff forecasting, Data processing, Simulation analysis, Precipitation(Atmospheric).  
**Identifiers:** \*Stochastic analysis.

The accuracy of currently used long-term runoff forecasting techniques, such as used by the Soil Conservation Service, are limited because of their inability to deal with the uncertainty in the amount of precipitation expected to fall after the forecast date. The basis for a simulation-based, long-term runoff forecasting technique is developed to overcome this problem by simulating future precipitation events. The technique utilizes a deterministic watershed snowmelt model and a sequence, event-based stochastic precipitation model to provide daily precipitation data inputs for the watershed model. A number of sets of inputs are run through the watershed model to produce an equal number of predictions of total seasonal runoff. A relative frequency distribution of total seasonal runoff is then plotted to which a PDF may be fitted. Various criteria were used to test the precipitation model. The majority showed no significant differences between the observed and simulated data. The lack of data prevented reasonable watershed model optimization and testing. Taking into consideration the poor watershed model response the forecasting technique responded well to the uncertainty in future precipitation and to abnormal monthly precipitation.  
W76-07764

**CLIMATOLOGICAL ESTIMATES OF EVAPOTRANSPIRATION,**  
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.  
For primary bibliographic entry see Field 2D.  
W76-07772

**SEASONAL VARIATIONS AND STATIONARITY,**  
Iceland Univ., Reykjavik. Science Inst.  
G. Gudmundsson.  
Nordic Hydrology, Vol. 6, No. 3, p 137-144, 1975.  
2 tab, 9 ref.

**Descriptors:** \*Analysis, \*Hydrologic data, \*Time series analysis, Seasonal, \*Variability, Evolution, Discharge measurement, Temperature, Precipitation(Atmospheric), Climates, Groundwater, Rivers, Thawing, Discharge(Water).  
**Identifiers:** \*Seasonal variations, \*Stationarity, \*Iceland, Evolutionary spectra.

A method was presented for testing second order stationarity against the alternative that seasonal variations take place in the autocovariance function. This was a modification of a test suggested by Priestly and Rao (1969) based on the concept of 'evolutionary spectra'. The method was applied to actual series of monthly data of discharge, temperature, and precipitation. Seasonal variations in mean and variance were eliminated before the test was applied, but highly significant seasonal variation was still present in some series. The observations had to be carried out over an interval of time long enough to enable satisfactory estimation of the relevant statistical process. Also, the second order properties of the series had to be almost constant during the interval of observations. (Roberts - ISWS)  
W76-07784

**SYNTHETIC MONTHLY RUN-OFF RECORDS FOR UNGAUGED BRITISH CATCHMENTS,**  
Northumbrian River Authority, Gosforth (England).  
For primary bibliographic entry see Field 4A.  
W76-08010

**KARST AND PALEOHYDROLOGY OF CARBONATE ROCK TERRANES IN SEMIARID AND ARID REGIONS WITH A COMPARISON TO HUMID KARST OF ALABAMA,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 2F.  
W76-08044

**HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 1. RUNOFF, PRECIPITATION, AND STORAGE CHARACTERISTICS,**  
Geological Survey, Tacoma, Wash.  
L. A. Rasmussen, and W. V. Tangborn.  
Water Resources Research, Vol 12, No 2, p 187-202, April 1976. 10 fig, 7 tab, 6 ref.

**Descriptors:** \*Streamflow forecasting, \*Hydrology, Hydrologic data, \*Washington, Equations, Data collections, Evaluation, Methodology, Stream gages, Ice, Snow, Altitude, Topography, Physical properties.  
**Identifiers:** \*North Cascade region(Wash).

The time and space distributions of measured precipitation and measured runoff and of spring storage, which is approximately equal to the subsequent summer runoff of snowmelt and stored groundwater, have been analyzed for the North Cascades region of Washington. Neither precipitation nor runoff shows a consistent relationship with altitude, chiefly because of precipitation-shadowing effects in this region of high relief. The relationship between mean annual precipitation and altitude is improved considerably when a topographic mean altitude is used instead of the actual altitude of the weather station. However, the improvement is not sufficient to explain a number of discrepancies that still occur. Some of the scatter in the precipitation-altitude plot appears to be due to a deficient precipitation catch by high-altitude gages. When the dependence of runoff on precipitation was examined on an annual, seasonal, and monthly basis, only a few low-altitude gages correlated well with basin runoff. In several instances, annual (water year) runoff could be better predicted from winter precipitation than from annual precipitation. (See also W76-08060)  
W76-08059

**HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 2. A PROPOSED HYDROMETEOROLOGICAL STREAMFLOW PREDICTION METHOD,**  
Geological Survey, Tacoma, Wash.  
W. V. Tangborn, and L. A. Rasmussen.  
Water Resources Research, Vol 12, No 2, p 203-216, April 1976. 4 fig, 8 tab, 19 ref.

**Descriptors:** \*Streamflow forecasting, \*Model studies, \*Hydrology, \*Meteorology, \*Washington, Methodology, Hydrologic data, Regression analysis, Hydrologic cycle, Snow, Ice, Rainfall.  
**Identifiers:** \*North Cascades region(Wash).

On the basis of a linear relationship between winter (October-April) precipitation and annual runoff from a drainage basin (Rasmussen and Tangborn, 1976) a physically reasonable model for predicting summer (May-September) streamflow from drainages in the North Cascades region in Washington was developed. This hydrometeorological prediction method relates streamflow for a season beginning on the day of prediction to the storage (including snow, ice, soil moisture, and groundwater) on that day. The spring storage is inferred from an input-output relationship based on the principle of conservation of mass: spring storage equals winter precipitation to the basin less winter runoff from the basin and less winter evapotranspiration. The method of prediction is based on data only from the years previous to the one for which the prediction is made,

## Field 2—WATER CYCLE

### Group 2A—General

and the system is revised each year as data for the previous year become available. Standard precipitation and runoff measurements in the North Cascades region are adequate for constructing a predictive hydrologic model. This model can be used to make streamflow predictions that compare favorably with current multiple regression methods based on mountain snow surveys. This method has the added advantages of predicting the space and time distributions of storage and summer runoff. (See also W76-08059) (Woodard-USGS)  
W76-08060

#### DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,

Witwatersrand, Johannesburg, Africa, Department of Civil Engineering.  
S. W. Bauer, and D. C. Midgley.  
The Civil Engineer in South Africa, Vol. 17, No. 8, p 199-202, August 1975. 4 fig, 3 tab, 5 ref.

Descriptors: \*Design flood, \*Floods, \*Rainfall, \*Routing, Equations, Hydrographs, Reservoir storage, Drainage, Evaluation, Design storm, Maps, Hyetographs, Systems analysis, Africa.  
Identifiers: South Africa.

Trials of several routing procedures for hydrograph synthesis revealed that routing of the excess rain hyetograph through a single linear reservoir-type storage could yield a plausible direct runoff hydrograph provided the shape and drainage pattern of the catchment was not abnormal. The method requires evaluation of only one parameter, the routing constant K, to define the hydrograph for an excess rain of given depth and duration. K values were determined for 92 South African catchments by seeking best-fits between routed and observed unitgraphs. To aid estimation of K for ungauged catchments, the country was subdivided into veld-type zones for each of which a relationship between K and area of catchment is provided. A worked example demonstrates the method. (Bell-Cornell)  
W76-08075

#### FLOOD PEAK ESTIMATES FROM SMALL RURAL WATERSHEDS,

Federal Highway Administration, Washington, D. C.  
D-C Woo.  
Public Roads, Vol. 38, No. 3, p 117-122, December 1974. 1 fig, 18 ref.

Descriptors: \*Highways, \*Drainage, \*Estimating, \*Floods, \*Hydrographs, Streams, Flood peak, Hydrologic data, Rural areas, Design, Simulation analysis, Research, Runoff, Rainfall.

The design of highway drainage structures depends on accurate estimates of flood hydrographs of streams that cross highways. This article describes the special characteristics of small rural watersheds and the Federal Highway Administration's extensive involvement in a program of small-stream gaging, data analysis, and methods development for such estimates. Available data on rainfall and streamflow from small rural watersheds are insufficient, and the geographical distribution of streamflow data is extremely poor. These conditions greatly hamper progress toward development of accurate general methods for estimation of flood peaks from small rural watersheds for nationwide use. However, better method for estimation of flood peaks can be developed for local use on the basis of marginal local data by researchers who know the area well. Accurate and sound methods of estimating flood peaks from small rural watersheds must be developed. This will require action on several fronts. The current program of national rainfall and streamflow data collection for small rural watersheds should be greatly expanded. Methods of generating more adequate local rainfall data should be studied. The best stratification schemes for regional analysis

should be identified and accurate regional and local models should be developed. (Bell-Cornell)  
W76-08077

## 2B. Precipitation

#### THERMAL SHOCK AS AN ICE MULTIPLICATION MECHANISM. PART I. THEORY,

New England Univ., Armidale (Australia). Dept. of Physics.  
W. D. King, and N. H. Fletcher.  
Journal of the Atmospheric Sciences, Vol. 33, No. 1, p 85-96, January 1976. 8 fig, 28 ref, 2 append.

Descriptors: \*Ice, \*Crystals, \*Drops(Fluids), Rime, Physical properties, Cloud physics, \*Thermal stress, Model studies, Mathematical models, Temperature, Precipitation(Atmospheric), Meteorology, Elastic theory.  
Identifiers: \*Ice crystal fractures, Thermoelastic theory.

Thermoelastic theory was used to calculate thermal stresses in ice crystals of idealized shapes when a small area on one surface is warmed to 0°C, in simulation of riming of the crystal by a cloud droplet. It was shown that a typical riming event involving a 20 micrometer diameter droplet impinging on a 500 micrometer plate or column would need to occur at a temperature colder than -35°C before fracture could be expected. For a given ice crystal size, the thermal stresses increase with droplet diameter, and thin thin plates rimed by large droplets are the most sensitive to thermal shock, but still need to be colder than -10°C before fracture would occur. It was consequently concluded that the thermal shock mechanism is unlikely to be responsible for the proliferation of ice crystals in clouds at temperatures as warm as -4°C. (See also W76-07548) (Sims - ISWS)  
W76-07547

#### THERMAL SHOCK AS AN ICE MULTIPLICATION MECHANISM. PART II. EXPERIMENTAL,

New England Univ., Armidale (Australia). Dept. of Physics.  
W. D. King, and N. H. Fletcher.  
Journal of the Atmospheric Sciences, Vol. 33, No. 1, p 97-102, January 1976. 8 fig, 3 ref.

Descriptors: \*Ice, \*Crystals, \*Drops(Fluids), Rime, Physical properties, Cloud physics, \*Thermal stress, Laboratory tests, Temperature, Precipitation(Atmospheric), Meteorology, Testing procedures.  
Identifiers: \*Ice crystal fractures.

Thermal shock tests were conducted on large numbers of ice spheres and plates, all of macroscopic size. The thermal shock was applied by cooling the specimens to the desired temperature, and then rapidly warming part of one surface by bringing water in contact with it. The spheres had a median cracking temperature of -16°C, and comparison with thermoelastic theory yielded tensile strength values for ice in the range 20-30 bars. Initiation of cracking in thick plates was a function of the temperature and of the ratio  $a/b$  (ratio of radius of warmed area to that of the cylindrical plate). For  $a/b=0.6$ , -20°C was the critical temperature, but for  $a/b$  less than 0.2, which is a more appropriate scaling factor in terms of riming of cloud particles, the samples had to be colder than -35°C before any cracks appeared. None of the samples fragmented or separated. Because the experimentally applied temperature changes were more severe than would be experienced by rimed ice crystals in clouds, it was concluded that thermal shock is unlikely to be an important ice multiplication mechanism at -5°C. (See also W-76 07547) (Sims - ISWS)  
W76-07548

#### WARM RAIN, GIANT NUCLEI AND CHEMICAL BALANCE-A NUMERICAL MODEL,

National Center for Atmospheric Research, Boulder, Colo.  
T. Takahashi.

Journal of the Atmospheric Sciences, Vol. 33, No. 2, p 269-286, February 1976. 17 fig, 64 ref. NSF GA-41024, ONR N00014-67-A-0387-0015.

Descriptors: \*Model studies, \*Cloud physics, \*Rainfall, \*Salts, Nucleation, Raindrops, Particle size, Tropical regions, Mathematical models, Clouds, Precipitation(Atmospheric), Condensation, Atmospheric physics, Chemistry of precipitation, Meteorology.

Identifiers: \*Warm rain, \*Giant nuclei, Raindrop size distributions, Terminal velocity, Liquid water content, Cloud droplet distributions, Salt content.

The role of giant nuclei in initiating warm rain was studied in a one-dimensional, time-dependent cylindrical model. Drop growth from cloud nuclei to raindrops through condensation and collection was calculated by keeping track of the salt mass in drops and by including scavenging of particles by drops. Drop distribution and salt content in rainwater were in reasonably good agreement with observations. It appears that while giant nuclei are important for chemical balance during cloud development, they are not important for warm rain initiation. Instead, cloud droplet concentration seems to be a more critical factor in initiating warm rain. (Sims - ISWS)  
W76-07549

#### CLIMATOLOGICAL IMPLICATIONS OF MICROPARTICLE CONCENTRATIONS IN THE ICE CORE FROM 'BYRD' STATION, WESTERN ANTARCTICA,

Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.  
For primary bibliographic entry see Field 2C.  
W76-07551

#### PITTSBURGH RAINWATER ANALYSIS BY PIXE,

Pittsburgh Univ., Pa.  
For primary bibliographic entry see Field 5A.  
W76-07555

#### SMALL SCALE TOPOGRAPHICAL INFLUENCES ON PRECIPITATION,

Norwegian Defense Research Establishment, Kjeller.  
P. B. Storebo.  
Tellus, Vol. 28, No. 1, p 45-59, 1976. 11 fig, 5 tab, 14 ref.

Descriptors: \*Rainfall, \*Precipitation(Atmospheric), \*Topography, Orography, Rainfall disposition, Rain drops, Fallout, Nucleation, Model studies, Mathematical models, Computer models, Cloud physics, Meteorology.

Small clouds may form above small hills when moist air blows over a landscape. Removal of droplets from these clouds by raindrops from above is the only suggested mechanism which directly links rainfall patterns to small scale topographical features. This mechanism was examined theoretically, and results from a series of computations were presented. The properties of condensation nuclei were found to be of minor importance for the condensation development, because the activation of nuclei dwindles off when enough droplets have been formed, and because a droplet assembly is an unstable phenomenon. Additional rainfall over small hills was found to be sufficiently large to explain observed influences of small scale terrain features on precipitation in Scandinavia. (Sims - ISWS)  
W76-07556

## WATER CYCLE—Field 2

### Snow, Ice, and Frost—Group 2C

**THE BEHAVIOR OF LARGE, LOW-SURFACE-TENSION WATER DROPS FALLING AT TERMINAL VELOCITY IN AIR,**  
Little (Arthur D.), Inc., Cambridge, Mass.

R. T. Ryan.

Journal of Applied Meteorology, Vol. 15, No. 2, p 157-165, February 1976. 12 fig, 23 ref. DAHCO-07-C-0061.

Descriptors: \*Drops(Fluids), \*Raindrops, \*Laboratory tests, Settling velocity, Equipment, Laboratory equipment, Surface tension, Surfactants, Meteorology.

Identifiers: \*Vertical wind tunnels, Drop breakup, Drop shape, Drop size, Terminal velocity.

A vertical wind tunnel was constructed to study the behavior of large, low-surface tension drops in free fall. The tunnel is simple, but provides a low turbulence (0.7%) flow which stably supports large water drops falling at terminal velocity. The influence of reduced surface tension on maximum drop size, drop terminal velocity, and drop shape was investigated. It was found that drops of low surface tension break up at a smaller size than drops with normal surface tension, are more deformed than drops of equal mass having normal surface tension, and have a lower terminal velocity than drops of equal mass and normal surface tension. Drops only partially coated with surfactant cannot be stably supported and undergo violent oscillations. Before any field testing of possible cloud modification by reducing rainwater surface tension is warranted, further investigation of the behavior of low-surface-tension drops should be undertaken and, in particular, the behavior of drops only partially coated with surfactant should be studied. (Sims - ISWS)  
W76-07560

**DETERMINATION OF THE FREQUENCY OF PRECIPITATION IN EXCESS OF DESIGN CRITERIA AT MORE THAN A SINGLE LOCATION DURING A HYDROLOGIC SEASON,**  
Missouri Univ., Columbia. Dept. of Atmospheric Science.

W. L. Decker.

Available from the National Technical Information Service Springfield, Va 22161, as PB-252 816, at \$6.00 in paper copy \$2.25 in microfiche. Completion Report, December 1975. 129 p, 28 fig, 16 tab, 53 ref, 3 append. OWRT A-078-MO (1) 14-31 0001-5025

Descriptors: Precipitation(Atmospheric), \*Rainfall, \*Design criteria, \*Precipitation excess, \*Illinois, \*Distribution patterns, Correlation analysis, Simulated rainfall.

Identifiers: Extreme value rainfall, Storm rainfall.

The exact and asymptotic distributions of the extreme value were considered for estimating the probability of excessive rains. By plotting the cumulative distributions on extreme probability paper and through the use of Kolmogorov-Smirnov test statistics, it was shown that the annual daily maximum rainfall from an area like Central Illinois fits the Fisher-Tippet type I distribution. The aerial decay of correlation coefficients in Central Illinois was studied by the use of 12 years data from 49 stations in the East Central Illinois Network. From these correlation coefficients it was possible to compute the parameter 'm' required in the bivariate extremal distribution. In the bivariate analysis, 'm' measures the degree of association between annual daily maximum rainfall from two locations. Using the computed 'm' values between stations, the joint probability of annual daily maximum rainfall exceeding the design criteria at each of the two locations was computed. Also the computation of conditional probability that one station's rainfall exceeds the design criteria given that the other stations rainfall exceeded its design criteria was also demonstrated. The possibility of applying the method to the joint probability of occurrence for more than two locations (multiple occurrence) was explored.  
W76-07581

**CLIMATOLOGICAL ESTIMATES OF EVAPOTRANSPIRATION,**  
Department of the Environment, Ottawa (Ontario). Hydrology Research Div.  
For primary bibliographic entry see Field 2D.  
W76-07772

**ISOTOPIC RATIOS OF RADIORUTHENIUM AND RADIOCERIUM IN RAIN WATER AT OSAKA IN RELATION TO NUCLEAR EXPLOSIONS DURING THE PERIOD OF LATE 1969 TO 1972,**

Radiation Center of Osaka Prefecture, Osaka (Japan). Dept. of Physical Instrument.  
For primary bibliographic entry see Field 5A.  
W76-07961

**ESTIMATION OF EVAPOTRANSPIRATION FOR WATER BALANCE STUDIES IN A SEMI-ARID REGION,**  
Indian Agricultural Research Inst., New Delhi. Div. of Agricultural Physics.

For primary bibliographic entry see Field 2D.  
W76-08067

**A STUDY OF MAJOR RAIN STORMS OVER AND NEAR MAHI BASIN UP TO KADANA DAM SITE FOR THE EVALUATION OF PROBABLE MAXIMUM DESIGN STORM,**  
Institute of Tropical Meteorology, Poona (India). O. N. Dhar, P. Rakhecha, and R. B. Sangam. Indian Journal of Power and River Valley Development, Vol. XXV, No. 1, p 29-34, January 1975. 2 fig, 5 tab, 16 ref.

Descriptors: \*Rain, \*Storms, \*River basins, Design storm, Dams, Frequency analysis, Estimating, Probability, Maps, Rain gages, Monthly, Annual, Monsoons.  
Identifiers: Mahi basin(India), Isohyetal method.

Mean monthly and annual rainfall of the Mahi basin up to Kadana dam site has been worked out by the isohyetal method on the basis of rainfall data of the period 1901-1950. Highest rain depths actually experienced by the Mahi basin up to Kadana dam site during the period 1902 to 1962 were also worked out for 1-, 2-, and 3-day durations on the basis of maximum rainfall experienced during these durations in each year of the above period. Using frequency analysis, return period of the highest rain depths experienced by the basin for different durations were determined. Maximum basin rain depths for the return periods of 500, 1000 and 10,000 years were also worked out on the basis of 61-year data of basin rainfall for the use of design engineers and hydrologists. Intense rainstorms which occurred in and around the basin during the 61-year period were also picked out and most severe rainstorms were selected for transposition over the basin in order to obtain probable maximum rain depths. The July 1927 rainstorm over north Gujarat was found to be the most severe rainstorm over this region and its transposed rain depths were determined. These were then maximized for moisture charge in order to obtain probable maximum rain depths over the Mahi basin. (Bell-Cornell)  
W76-08069

## 2C. Snow, Ice, and Frost

**THERMAL SHOCK AS AN ICE MULTIPLICATION MECHANISM. PART I. THEORY,**  
New England Univ., Armidale (Australia). Dept. of Physics.

For primary bibliographic entry see Field 2B.  
W76-07547

**THERMAL SHOCK AS AN ICE MULTIPLICATION MECHANISM. PART II. EXPERIMENTAL,**  
New England Univ., Armidale (Australia). Dept. of Physics.  
For primary bibliographic entry see Field 2B.  
W76-07548

**AN APPROXIMATE ANALYSIS OF MELTING AND FREEZING OF A DRILL HOLE THROUGH AN ICE SHELF IN ANTARCTICA,**  
Syracuse Univ., N.Y. Dept. of Chemical Engineering and Material Sciences.  
C. Tien, and Y-C. Yen.

Journal of Glaciology, Vol. 14, No. 72, p 421-432, 1975. 4 fig, 3 ref, 1 append.

Descriptors: \*Antarctic, \*Cold regions, \*Drill holes, \*Ice, Freezing, Melting, Thawing, Mathematical studies, Model studies, Mathematical models, Heat transfer, Heat flow, Heating, Glaciology.  
Identifiers: \*Ice shelves.

An approximate analysis of the processes of melting and freezing of a drill hole, 500 m depth and 0.15 m in initial radius, through an ice shelf was made. Results were expressed in graphical form showing the time available for experimentation under the hole as a function of heating duration. It was also found that refreezing has a much slower rate than melting. (Sims - ISWS)  
W76-07550

**CLIMATOLOGICAL IMPLICATIONS OF MICROPARTICLE CONCENTRATIONS IN THE ICE CORE FROM 'BYRD' STATION, WESTERN ANTARCTICA,**  
Ohio State Univ. Research Foundation, Columbus. Inst. of Polar Studies.

L. G. Thompson, W. L. Hamilton, and C. Bull. Journal of Glaciology, Vol. 14, No. 72, p 433-444, 1975. 7 fig, 1 tab, 26 ref. NSF OPP71-04063-A02.

Descriptors: \*Antarctic, \*Paleoclimatology, \*Ice, Volcanoes, Dusts, Temperature, Climatology, Laboratory tests, Radioactive dating.  
Identifiers: \*Ice cores, Ice sheets, Microparticles, Particle concentrations.

The concentration of microparticles in the 2164 m long ice core from 'Byrd' station, Antarctica, varies cyclically. Highest concentrations of 0.65 micrometer diameter microparticles occur where oxygen-isotope studies show lowest paleotemperatures. The age of the bottom ice estimated from microparticle-concentration variations, assuming an annual cycle, is 27,000 years, much less than from oxygen-isotope studies. (Sims - ISWS)  
W76-07551

**TESTS OF THE CONCEPT OF SECONDARY FROST HEAVING,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agronomy.  
J. P. G. Loch, and R. D. Miller.  
Soil Science Society of America Proceedings, Vol. 39, No. 6, p 1036-1041, November-December 1975. 5 fig, 1 tab, 20 ref. CRREL DA-ENG-27021-72-G32, NSF GK-42050.

Descriptors: \*Frost heaving, \*Frozen ground, \*Frozen soils, Permafrost, Freezing, Frost, Ice, Soil water, Pore water, Soils, Laboratory tests, Laboratory equipment.  
Identifiers: Ice lenses.

Heaving tests were conducted with 2-4, 4-8, and 8-16 micrometer soil fractions in special apparatus in which sliding friction (during heaving) was eliminated by confining the specimen as in standard triaxial test apparatus. Maximum pressures developed by heaving exceeded those computed by a primary heaving model (using air intrusion data) by factors as large as 3 to 6. Maximum pres-

## Field 2—WATER CYCLE

### Group 2C—Snow, Ice, and Frost

sures and rates of heave at constant pressures depended on temperature gradient and were maximal at gradients between 1 and 3°C per cm. Comparisons were simplified transport equations for a frozen fringe adjacent to a growing ice lens (the characteristic feature of secondary heaving) indicated that pore ice in the frozen fringe contributes to water transport for lens growth, but this may be offset by plastic counter-flow of ice at large temperature gradients, accounting for the gradient-dependent maxima. Results were interpreted as supporting the concept of secondary heaving. (Sims-ISWS)

W76-07558

**RUNOFF STUDIES ON SMALL WATERSHEDS,**  
West Virginia Univ., Morgantown. Water Research Inst.  
For primary bibliographic entry see Field 2A.

W76-07673

**GLACIER SURVEYS IN ALBERTA - 1971,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
I. A. Reid, and J. O. G. Charbonneau.  
Water Resources Branch Report Series No. 43, 1975, 18 p., 10 fig., 6 ref., 15 tab.

Descriptors: \*Glaciers, \*Surveys, Photogrammetry, Mapping, Profiles, Elevation, \*Canada.  
Identifiers: \*Alberta, Water Survey of Canada, Athabasca Glacier, Saskatchewan Glacier, Mathematical computations, Volumetric change.

Glaciers act as natural regulators, storing water in winter and releasing it in summer. To gain some understanding of this phenomenon and the contribution which glaciers make to streamflow, the predecessors of the Water Survey of Canada began glacier surveys in 1945. The earlier surveys offered some clue to the role of the glacier, but the data collected were not sufficient to provide the overall picture. Following adoption of photogrammetric survey techniques, however, the glacier surveys have evolved to the extent that it is now feasible to produce a series of maps from which the linear, areal, directional and volumetric changes can be determined. The surveys have revealed that the glaciers, in general, are becoming smaller in size; hence the regulation effect is diminishing in the area of ablation. (Environment Canada)

W76-07680

**ESTIMATING WATER TEMPERATURES AND TIME OF ICE FORMATION ON THE SAINT LAWRENCE RIVER,**  
National Oceanic and Atmospheric Administration, Detroit, Mich. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 2E.

W76-07765

**THE SPECIFIC HEAT OF SALINE ICE,**  
McGill Univ., Montreal (Quebec). Ice Research Project.  
B. Dixit, and E. R. Pounder.  
Journal of Glaciology, Vol. 14, No. 72, p 459-465, 1975. 3 fig., 2 tab., 5 ref.

Descriptors: \*Specific heat, \*Ice, \*Salinity, Latent heat, Thermal properties, Physical properties, Physical properties, Laboratory tests, Sea ice, Salts.

A calorimetric experiment was performed to determine empirically the dependence of the specific heat of ice with salinity 0-10 parts per thousand over the temperature range from -23°C to the melting point. The experimental results agreed with the theoretical model determined by Schwerdtfeger for calculating the specific heat except within several degrees of the melting point and for very pure ice. (Sims-ISWS)

W76-07776

**SOURCE, TRANSPORTATION AND DEPOSITION OF DEBRIS ON ARAPAHO GLACIER, FRONT RANGE, COLORADO, U.S.A.,**  
Colorado Univ., Boulder. Dept. of Geological Sciences; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.  
M. J. Reheis.

Journal of Glaciology, Vol. 14, No. 72, p 407-420, 1975. 6 fig., 2 tab., 32 ref.

Descriptors: \*Glaciers, \*Glacial sediments, \*Glacial drift, \*Colorado, \*Rocky Mountain region, Gravels, Rocks, Sands, Till, Sediments, Ice, Cirques, Mountains, Movement, Geomorphology, Rock glaciators, Glaciology.

Identifiers: \*Arapaho Glacier(Colo), Debris content.

This study was undertaken to determine the sources of debris and methods of transportation and deposition in and on a small cirque glacier. Data were collected on the amount of debris, stone roundness, the presence of striations and polish, and till fabric. Lichenometry gave relative ages of the tills, and suggested that the Gannett Peak till is of at least three ages and probably overlies Audubon till. Debris originating from subglacial erosion can be differentiated from that from rockfall or avalanches on stone roundness, polish and striations. A maximum of 70% of the present glacial load derives from subglacial erosion, as compared to 88% during the Gannett Peak stade. Rockfall rates are 35-50 cu m/year at present and were 290-485 cu m/year during the Gannett Peak stade. Data on present-day processes and on the volume and age of Gannett Peak moraines can be used to make comparisons on present and past rates of denudation. The denudation rate in the cirque at present is 95-165 mm/1000 year; in the past it was 4920-8160 mm/1000 year. The denudation rate and the glacial effects on debris are comparable to rates from other glacial areas and effects on debris carried by valley glaciers and continental ice sheets. (Sims-ISWS)

W76-07777

**QUANTITATIVE STEREOLOGICAL ANALYSIS OF GRAIN BONDS IN SNOW,**  
Eidgenoessische Institut fuer Schnee- und Lawinenforschung, Davos (Switzerland).

P. R. Kry.  
Journal of Glaciology, Vol. 14, No. 72, p 467-477, 1975. 6 fig., 1 tab., 12 ref.

Descriptors: \*Snow, \*Laboratory tests, \*Physical properties, Analytical techniques, Particle size, Crystals.

Identifiers: \*Grain bonds, \*Stereological analysis, Grain-bond size.

A section-plane preparation technique and an operational definition of a snow grain bond were developed to allow quantitative analysis of bonding in snow structure. Values for three-dimensional grain size, grain-bond size and number density, and related bonding measurements were presented for equitemperature metamorphosed snow. These results from mutually orthogonal planes within a given snow block showed that the assumptions of randomness and isotropy of grain and grain-bond location and orientation, necessary for stereological analysis from one plane, are satisfied to within + or - 10% even after 30% uniaxial plastic deformation of the snow block. The idealization of a grain bond as a circular plane disk yielded self-consistent results. The number of bonds per grain cannot be accurately determined from two-dimensional studies due to variations in the shape and size of snow grains within a given sample. (Sims-ISWS)

W76-07778

**THE RELATIONSHIP BETWEEN THE VISCO-ELASTIC AND STRUCTURAL PROPERTIES OF FINE-GRAINED SNOW,**  
Eidgenoessische Institut fuer Schnee- und Lawinenforschung, Davos (Switzerland).

P. R. Kry.

Journal of Glaciology, Vol. 14, No. 72, p 479-500, 1975. 13 fig., 3 tab., 18 ref.

Descriptors: \*Snow, \*Physical properties, \*Laboratory tests, Compaction, Mechanical properties, Compressive strength, Young's modulus, Structural behavior, Stress, Strain, Strength.

Identifiers: \*Grain bonds, Grain-bond size.

New and felt-like snow was sieved and sintered at a constant temperature in order to produce homogeneous samples of fine, rounded-grain snow with a density in the range 270-340 kg/cu m. The structure of single samples was changed in stages by nondestructive uniaxial compression. This deformation, which amounted to 30%, took place within 8 hours (thus limiting temperature metamorphism). At each stage the Young's modulus was measured quasi-statically and the creep behavior under constant uniaxial compression was recorded. Stereological analysis of sections from the samples provided mean values for both grain-bond and grain properties. The Young's modulus increased with density slightly more strongly than linearly, whereas the low-stress viscosity in unconfined compression increased nearly exponentially for densities less than 380 kg/cu m. The maximum densification resulted in a 15-fold increase in the measured viscoelastic properties. However, the number of grain bonds per unit mass increased linearly by a factor in the range 1.5 to 2 while the average grain-bond size remained constant. It was concluded that only a fraction of the grain bonds in a snow sample transmit an applied stress, and that the new grain bonds formed during the deformation of a snow sample determine the visco-elastic properties of snow. (Sims-ISWS)

W76-07779

**ELECTROMAGNETIC REFLECTION FROM MULTI-LAYERED SNOW MODELS,**  
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.

W. L. Linlor, and G. R. Jiracek.  
Journal of Glaciology, Vol. 14, No. 72, p 501-515, 1975. 12 fig., 2 tab., 16 ref.

Descriptors: \*Snow, \*Ice, \*Measurement, \*Remote sensing, Electromagnetic waves, Reflectance, Model studies, Mathematical models, Melt water, Snowpacks, Snow cover, Water resources, Electrical properties, Instrumentation.

Identifiers: \*Dielectric properties.

The remote sensing of snow-pack characteristics with surface installations or an airborne system could have important applications in water-resource management and flood prediction. To derive some insight into such applications, the electro-magnetic response of multi-layered snow models was analyzed. Normally incident plane waves at frequencies ranging from 1 to 10,000 MHz are assumed, and amplitude reflection coefficients are calculated for models having various snow-layer combinations, including ice layers. Layers are defined by a thickness, permittivity, and conductivity; the electrical parameters are constant or prescribed functions of frequency. To illustrate the effect of various layering combinations, results were given in the form of curves of amplitude reflection coefficients versus frequency for a variety of models. Under simplifying assumptions, the snow thickness and effective dielectric constant can be estimated from the variations of reflection coefficient as a function of frequency. (Sims-ISWS)

W76-07780

## Evaporation and Transpiration—Group 2D

**LOW-TEMPERATURE HEAT CONDUCTION IN PURE, MONOCRYSTALLINE ICE,**  
Université Scientifique et Médicale de Grenoble  
(France). Laboratoire de Spectrométrie Physique.  
J. Klinger.  
Journal of Glaciology, Vol. 14, No. 72, p 517-528,  
1975. 6 fig, 23 ref.

Descriptors: \*Ice, \*Thermal conductivity, \*Heat transfer, Crystals, Crystal growth, Growth rates, Laboratory tests, Thermal properties, Physics, Physical properties, Conductivity, Measurement, Glaciology.

The heat conduction of ice single crystals was measured by a steady-state heat-flux method between 1.7 K and 100 K. For temperatures higher than 16 K all experimental points were found to be on the same curve. For temperatures lower than 16 K the heat conduction curves depended on the material of the crystallization vessel, the aging of the sample and the cooling rate between the temperature of the mount (about 260 K) and liquid-nitrogen temperature. No anisotropy could be found for temperatures higher than 9 K. Computer fits were made, based on Callaway's model of heat conduction in dielectric crystals. An attempt was made to explain the observed extrinsic heat conduction by the presence of microstructures in ice. It was shown that heat-conduction measurement can be used to establish a 'quality-list' of samples studied in laboratories. (Sims - ISWS)  
W76-07781

**ISUA, GREENLAND: GLACIER FREEZING STUDY,**  
Cold Regions Research and Engineering Lab.,  
Hanover, N.H.  
G. D. Ashton.

Available from the National Technical Information Service, Springfield, Va., 22161 as ADA-009 705 \$4.00 in paper copy, \$2.25 in microfiche. Research Report 334, April 1975. 19 p, 6 fig, 2 tab, 10 ref.

Descriptors: \*Freezing, \*Glaciers, Movement, \*Cooling, Mining, Mining engineering, Drill holes, Shafts(Excavations), Cold regions, Ice, Ice cover, Coolants, Heat transfer, Physical properties. Identifiers: \*Greenland, \*Isua(Greenland).

A scheme for cooling the lower portion of the edge of the Greenland ice sheet, which abuts a potential mining operation, was examined. The magnitude of cooling which may be accomplished by drilling a series of holes about the periphery of the mine site was determined as a function of hole size, spacing and time. Refrigeration was accomplished by pumping a coolant downhole in a central pipe, then uphole in an annulus between the pipe and hole wall, and then through a thin-walled pipe exposed to the surface climate above the ice sheet. It was found possible to achieve a temperature change in the ice of the order of -1 C with hole spacings and pumping requirements which are considered reasonable. Other effects were briefly examined and included an estimate of the basal water thickness and flow rates. (Sims - ISWS)  
W76-07789

**MODEL INVESTIGATIONS OF ICE ENTRAINMENT BENEATH EDGE OF AN COVER ICE.**  
A. M. Filippov.

Available from the National Technical Information Service, Springfield, Va., 22161, as ADA-009 694 \$3.50 in paper copy, \$2.25 in microfiche. CRREL Draft Translation 475, May 1975. 8 p, 3 fig, 4 ref. Translated from Trudy Gosudarstvennogo Instituta, No. 201, p 107-114, 1973.

Descriptors: \*Model studies, \*Ice cover, \*Rivers, Movement, Ice jams, Ice-water interfaces, Slush, Drifting(Aquatic), Currents(Water), Ice.

Model investigations of the drawing in of slush and ice under the edge of an ice sheet are a component

part of the study of ice-dam and ice-jam formation processes in rivers, as well as a stage in the experimental development of methods for the hydraulic regulation of slush and ice movements. By using this type of research, it is possible to determine the conditions governing the drifting of ice blocks of various lengths, widths and thicknesses under an ice sheet for flows having different hydraulic parameters. (Sims - ISWS)  
W76-07790

**2D. Evaporation and Transpiration**

**VARIATION IN EVAPORATIVE POWER ON SLOPES OF DIFFERENT EXPOSURE AND STEEPNESS IN THE USSR,**  
Ye. N. Romanova.

Soviet Hydrology, Selected Papers, No. 5, p 334-343, 1974. 2 fig, 7 tab, 7 ref. Translated from Transactions of the Main Geophysical Observatory (Trudy GGO), No. 339, p 35-47, 1974.

Descriptors: \*Evaporation, \*Slopes, \*Mountains, \*Climates, Physical properties, Solar radiation, Latent heat, Water loss, Climatology, Meteorology. Identifiers: \*USSR.

Study of the characteristics of evaporative power on different slopes is important for the theory of the microclimate and for solving some applied problems in meteorology, agroclimatology, etc. Of all the existing methods for determining evaporative power, the method where evaporative power is determined from the ratio of the net radiation of a wetted surface to the latent heat of vaporization, is most suitable for determining evaporative power on slopes, since it is free of errors in the computation of evaporative power by the other methods in a rugged relief. This is the method used here to compute evaporative power on slopes. Evaporative power was computed for the four major exposures (north, south, east, and west) of slopes with a steepness of 5, 10, 15, and 20 degrees. A gradual increase in evaporative power with increasing slope steepness and from zone to zone was observed on northern and southern slopes. On 5 deg northern slopes, evaporative power decreased by comparison with level areas by 3.5 cm in the excessively wet zone and by 6.5 cm in the arid zone, whereas on the same slopes of 20 deg it was decreased by 15.0 and 28.1 cm, respectively. A similar pattern was observed on southern slopes, but evaporative power on these slopes differed less from that on a level area than on northern slopes: it increased by 17.6 cm on a 20 deg southern slope. (Sims-ISWS)  
W76-07554

**PROBABILITY STUDIES OF AGRICULTURAL WATER MANAGEMENT IN HARYANA STATE,**  
Haryana Agricultural Univ., Hissar (India).

O. P. Bishnoi.  
Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 26, No. 1, p 101-104, January 1975. 5 fig, 1 tab, 4 ref.

Descriptors: \*Irrigation, \*Farm management, \*Rainfall, \*Evaporation, Precipitation(Atmospheric), Evapotranspiration, Water supply, Planting management, Dry farming, Soil moisture, Drainage, Climatology. Identifiers: \*India.

The probability of water surplus and deficiencies have been utilized in viewing the problems of agricultural water management. For maximization of the yield, the supply system must be based on the amount of water deficits and their durations. At Ambala, maximum water storage capacity is attained only once in 11 years for 150 days duration from July. The Kharif crop of 90 days duration can successfully be taken once in 2 years, the crops of 120 days duration can succeed in 2 out of 5 years, whereas the crops of still longer duration, i.e., 150

days can grow well only once in 3 years without moisture stress. An adequate amount of water is required even during the rainy season at Hissar. During the monsoon months, the drainage capacity of 7 mm/day is desired once in 2 years. The climatic conditions are suitable during July 12 to September 14 and December 15 to February 17 at Ambala once in 2 years for storing the water in anticipation of the demand. (Sims-ISWS)  
W76-07770

**CLIMATOLOGICAL ESTIMATES OF EVAPOTRANSPIRATION,**

Department of the Environment, Ottawa (Ontario). Hydrology Research Div.

F. I. Morton.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY3, Proceedings Paper 11974, p 275-291, March 1976. 5 fig, 1 tab, 15 ref, 2 append.

Descriptors: \*Climatology, \*Evapotranspiration, \*Evaporation, Hydraulics, Hydrology, Rainfall, Rivers, Runoff, Model studies, Hydrologic budget, Evaporation pans, Deserts, Irrigated land. Identifiers: \*Climatological observations, Potential evaporation.

Interactions between evaporating surfaces and the overpassing air suggested that potential evaporation responds in a complementary way to changes in the availability of water for evapotranspiration from the surrounding area. Supporting evidence was found in an analysis of dish and pan evaporation data from irrigated areas and adjoining deserts. The concept was used as the basis for a model which provides estimates of evapotranspiration from routine climatological observations without the need for assumptions concerning the soil-vegetation system and its effects on the availability of water. The model was calibrated at climatological stations in desert areas, where the monthly precipitation approximates evapotranspiration, and applied without local optimization of coefficients over a wide range of environments. The versatility of this unorthodox concept was demonstrated by comparing model and water budget estimates of evapotranspiration for 120 river basins in Canada, Ireland, Kenya, and the southern United States. (Roberts-ISWS)  
W76-07772

**RESISTANCE TO WATER FLOW IN SOIL AND PLANTS, PLANT WATER STATUS STOMATAL RESISTANCE AND TRANSPIRATION OF ITALIAN RYEGRASS, AS INFLUENCED BY TRANSPIRATION DEMAND AND SOIL WATER DEPLETION,**

Royal Veterinary and Agriculture Co., Copenhagen (Denmark). Hydrotechnical Lab. For primary bibliographic entry see Field 21.  
W76-07958

**ESTIMATION OF EVAPOTRANSPIRATION FOR WATER BALANCE STUDIES IN A SEMIARID REGION,**

Indian Agricultural Research Inst., New Delhi. Div. of Agricultural Physics.

P.S.N. Sastry, and N.V.K. Chakravarty.

Indian Journal of Power and River Valley Development, Vol. XXV, No. 9, p 288-290, September 1975. 1 fig, 2 tab, 10 ref.

Descriptors: \*Evapotranspiration, \*Water balance, Semiarid climates, Estimating, Irrigation, Scheduling, Monsoons, Evaporimeters, Meteorology.

Derivation of water balance in a region for purposes of irrigation scheduling on an operational basis requires measurement or estimation of potential evapotranspiration (PET). With a view to assess the applicability of the different formulae currently in use, PET obtained during the south west monsoon season over 10-day periods for

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three years were estimated using the formulae developed by (a) Penman, (b) Blaney-Criddle and (c) Papadakis. These have been related to the measured values of evaporation from the standard class A-mesh covered pan evaporimeter. It was observed that estimates of PET made by Penman and Blaney-Criddle methods are fairly comparable with the pan evaporation values when they lie between 4 to 5 mm/day which is also incidentally the average pan evaporation value for the Delhi region during the monsoon season. At other values, there is wide disagreement. Estimation of daily PET using Penman's method during the monsoon season in semi-arid environments like the Delhi region is not recommended for computing daily water balance. (Bell-Cornell)  
W76-08067

## 2E. Streamflow and Runoff

FOURMILE RUN LOCAL FLOOD-CONTROL PROJECT, ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA; HYDRAULIC MODEL INVESTIGATION,  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07469

TOPOGRAPHIC EXPRESSION OF SUPERIMPOSED DRAINAGE ON THE GEORGIA PIEDMONT,  
Georgia State Univ., Atlanta. Dept. of Geology.  
For primary bibliographic entry see Field 2J.  
W76-07553

NUMERICAL CALCULATION OF THE WAVE INTEGRALS IN THE LINEARIZED THEORY OF WATER WAVES,  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 8B.  
W76-07565

CHEMICAL CHARACTERISTICS OF THE LOWER KISSIMMEE RIVER, FLORIDA--WITH EMPHASIS ON NITROGEN AND PHOSPHORUS,  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5A.  
W76-07603

PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS,  
Arizona Univ., Tucson. School of Renewable Natural Resources.  
For primary bibliographic entry see Field 2A.  
W76-07764

ESTIMATING WATER TEMPERATURES AND TIME OF ICE FORMATION ON THE SAINT LAWRENCE RIVER,  
National Oceanic and Atmospheric Administration, Detroit, Mich. Great Lakes Environmental Research Lab.  
C. E. Adams, Jr.

Limnology and Oceanography, Vol. 21, No. 1, p 128-137, January 1976. 4 fig, 5 tab, 18 ref.

Descriptors: \*St. Lawrence River, \*St. Lawrence Seaway, \*Freezing, \*Water temperature, Forecasting, Heat flow, Heat transfer, Heat balance, Cooling, Ice, Evaporation, Rivers, Navigation, Mathematical models.

Monthly mean heat losses from the surface of the St. Lawrence River during the fall-winter cooling period were determined by an empirical heat budget which incorporated the processes of radiation, conduction, convection, and precipitation.

Calculations indicated that the heat loss can be reasonably represented by a simple linear relation with air-water temperature differential. It was suggested however, that the coefficient of proportionality changes with variations in the ratio of radiation to evaporation. An equation was evaluated which relates surface heat loss to temperature decline along the international section of the river. Within the limits of accuracy of the heat loss calculations, the equation provided adequate estimates of water temperature changes for the period of study. The water temperature decline equation was used as the basis for developing a prediction technique which enables river freeze-up estimates to be made as early as 1 October. When observed freeze-up dates were used, predictions for a 6-year period (1965-1970) yielded standard deviations of 4.7, 3.3, and 3.5 days for predictions starting at the beginning of October, November, and December. Observed freeze-up occurred within 2 days of the predicted date in 4 of the 6 years examined. Experimental predictions for two additional years yielded similar results. (Sims-ISWS).  
W76-07765

FLOOD ESTIMATION FROM SHORT RECORDS,  
Queensland Irrigation and Water Supply Commission, Brisbane (Australia).  
For primary bibliographic entry see Field 4A.  
W76-07771

SEASONAL VARIATIONS AND STATIONARITY,  
Iceland Univ., Reykjavik. Science Inst.  
For primary bibliographic entry see Field 2A.  
W76-07784

ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1975,  
Geological Survey, Helena, Mont.  
M. V. Johnson, R. J. Omang, and J. A. Hull.  
Open-file report, 1976. 204 p, 2 fig.

Descriptors: \*Peak discharge, \*Small watersheds, \*Montana, \*Basic data collections, Streamflow, Hydrologic data, Floods, Discharge(Water).

A program to investigate the magnitude and frequency of floods from small drainage areas in Montana was begun July 1, 1955. This, the twenty-first annual report, is primarily a tabulation, by water year, of the annual peak stage and discharge at each crest-stage gaging station. Also, it summarizes the activities and progress made during the 1975 water year. During the 1975 water year 212 gages were operated, 178 east of the Continental Divide and 34 west of the Divide. Substantial peak flows occurred during the water year; however, runoff patterns varied greatly. Along the west side of the Continental Divide high flows in May or June were caused by combined snowmelt and rain. Peak flows in high mountain areas east of the Divide were caused mainly by snowmelt, but in part by rain. In the prairie area peak flows were mostly caused by isolated rainstorms during summer and spring. Peak flow of record was equalled or exceeded at 56 sites. (Woodard-USGS)  
W76-08049

HYDRAULIC EFFECTS OF CHANGES IN BOTTOM-LAND VEGETATION ON THREE MAJOR FLOODS, GILA RIVER IN SOUTHEASTERN ARIZONA,  
Geological Survey, Sacramento.  
For primary bibliographic entry see Field 4C.  
W76-08050

HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 1. RUNOFF, PRECIPITATION, AND STORAGE CHARACTERISTICS,  
Geological Survey, Tacoma, Wash.

For primary bibliographic entry see Field 2A.  
W76-08059

HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 2. A PROPOSED HYDROMETEOROLOGICAL STREAMFLOW PREDICTION METHOD,  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2A.  
W76-08060

DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,  
Witwatersrand, Johannesburg, Africa, Department of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W76-08075

## 2F. Groundwater

A SIMPLIFIED APPROACH FOR THE ANALYSIS OF UNSTEADY FLOW TO A CAVITY WELL,  
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.  
R. S. Kanwar, S. D. Khepar, H. S. Chauhan, and G. Das.  
Ground Water, Vol. 14, No. 2, p 101-105, March-April 1976. 3 fig, 1 tab, 9 ref.

Descriptors: \*Groundwater, \*Model studies, \*Wells, \*Aquifer characteristics, Aquifers, Hydraulic conductivity, Storage coefficient, Unsteady flow, Drawdown, Hydraulics.  
Identifiers: \*Cavity wells.

An analytical solution obtained for unsteady flow to a cavity well has been simplified for finding the aquifer characteristics. In the analysis presented, the relationships become fairly simple for the close approximation of the unsteady state solution. The simplified solution is of great importance for finding the values of storage coefficient and hydraulic conductivity. This solution has large important economic implications, since the formation constants of the aquifer can be found without drilling in the aquifer and installing the screens. If the values of S and K found from these relations are fairly satisfactory after a pumping test, the other more expensive methods which require a fully penetrating well may not be needed. (Sims-ISWS)  
W76-07561

WATER MOVEMENT THROUGH SATURATED-UNSATURATED POROUS MEDIA: A FINITE-ELEMENT GALERKIN MODEL,  
Oak Ridge National Lab., Tenn.  
M. Reeves, and J. O. Duguid.  
Report ORNL-4927, February 1976. 236 p, 11 fig, 1 tab, 29 ref, 5 append.

Descriptors: \*Unsteady flow, \*Saturated flow, \*Unsaturated flow, \*Finite element analysis, \*Computer programs, Computer models, Groundwater movement, Porous media, Equations, Infiltration, Seepage, Boundaries(Surfaces), Model studies.  
Identifiers: \*Galerkin technique, \*FORTRAN.

A two-dimensional transient model for flow through saturated-unsaturated porous media has been developed. This model numerically solves the governing partial differential equations, which are highly nonlinear. The model code uses quadrilateral finite elements for the geometrical assembly, bilinear Galerkin interpolation for the spatial integration, and Gaussian elimination for the solution of the resulting matrix equations. In addition to the usual constant-flux and constant-head boundary conditions, the code is capable of applying pressure-dependent boundary conditions at the ground surface. Thus, infiltration into or seepage

**WATER CYCLE—Field 2****Groundwater—Group 2F**

from this surface may be simulated. Each element may be assigned different material properties that allow the investigation of layered geologic formations. The report was intended for use as a complete user's manual and contains a listing of the computer code (in FORTRAN) along with both input and output data for two example problems. The results of a computer simulation compared favorably with experimental data obtained from an inclined soil slab at Coweeta Hydrologic Laboratory in North Carolina. The Galerkin finite-element method was found to be superior to the finite-difference method used by previous investigators. By exploiting the flexibility of the finite-element geometrical discretization, the user may easily reduce computer running time by a factor of two. (Visocky-ISWS)  
W76-07569

**ANNUAL WATER-RESOURCES REVIEW,  
WHITE SANDS MISSILE RANGE, 1975—A  
BASIC-DATA REPORT,**  
Geological Survey, Albuquerque, N. Mex.  
For primary bibliographic entry see Field 4B.  
W76-07588

**DIGITAL MODEL OF THE GRAVEL AQUIFER,  
WALLA WALLA RIVER BASIN, WASHING-  
TON AND OREGON,**  
Geological Survey, Tacoma, Wash.

R. A. Barker, and R. D. Mac Nish.

Washington Department of Ecology, Olympia, Water-Supply Bulletin 45, 1976. 49 p., 18 fig., 1 plate, 2 tab, 24 ref.

Descriptors: \*Groundwater recharge, \*Computer models, \*Groundwater basins, \*Irrigation effects, \*Water level fluctuations, Aquifer characteristics, Washington, Oregon, Drawdown, Surface-groundwater relationships, Groundwater movement, Gravels.

Identifiers: \*Walla Walla River basin(Wash-Oreg), \*Gravel aquifers.

A digital model using a finite-difference technique simulates hydrologic characteristics of a gravel aquifer which underlies about 120,000 acres of the Walla Walla River basin's interior low-land in Washington and Oregon. The gravel aquifer is underlain by a basalt aquifer system and is coupled to an extensive surface network of streams, canals, and springs. The model permits testing of various water-management alternatives involving the spatial and temporal distribution of well pumping, irrigation application, and surface-water diversion. Trial-and-error simulation of hydrologic phenomena characteristic of the aquifer during typical, recent years (and believed to be applicable for 5-10 years in the future) was used to calibrate the model. Time-dependent fluxes were programmed for each month of the model year on the basis of recently observed local irrigation practices and pumping withdrawals, average crop requirements, and long-term precipitation. The calibrated aquifer hydraulic conductivities range from slightly less than .000155 to .00250 foot per second. Storage coefficients range from 0.1 to 0.25. After beginning the simulation with water levels contoured for January and continuing for 1 year, the calibrated model computed levels to within 10 feet of those originally contoured over about 95 percent of the modeled area—the match was within 5 feet over about 50 percent of the area. (Woodard-USGS)  
W76-07593

**AQUIFER TESTS IN THE SUMMIT REACH OF  
THE PROPOSED CROSS-FLORIDA BARGE  
CANAL NEAR OCALA, FLORIDA,**  
Geological Survey, Tallahassee, Fla.

C. H. Tibbals.

Available from the National Technical Information Service, Springfield, Va 22161, as ADA-021 586, \$4.00 printed copy; \$2.25 microfiche. Water-Resources Investigations 28-75, August 1975. 42 p., 18 fig., 5 tab, 6 ref.

Descriptors: \*Aquifer testing, \*Aquifer characteristics, \*Canal seepage, \*Water pollution, \*Florida, Groundwater, Water table aquifers, Canal construction, Boundaries(Surfaces), Hydraulic conductivity, Saline water intrusion, Anisotropy, Heterogeneity, Groundwater recharge.

Identifiers: \*Cross-Florida barge canal, \*Floridan aquifer, \*Marion County(Fla).

The Summit Pool reach of the proposed Cross-Florida Barge Canal will be excavated into the Floridan aquifer at least 12 feet below the water table. Particular areas of concern are 'outflow' areas where water is expected to pass from the canal into the aquifer. Methods are described that deal with unique boundary conditions and aquifer anisotropy at two sites. Extreme aquifer heterogeneity precluded the determination of aquifer coefficients at one of the sites and probably affected the results of the tests at the other two. Therefore, the calculated aquifer coefficients reported should be regarded only as estimates. Calculated coefficients of horizontal hydraulic conductivity ranged from 0.025 to 3,500 gallons per day per square foot and calculated coefficients of vertical hydraulic conductivity ranged from 0.05 to 23,000 gallons per day per square foot. Ratio of horizontal to vertical hydraulic conductivity ranged from 0.09 to 2.9. (Woodard-USGS)  
W76-07599

**GEOHYDROLOGY OF THE LAKE AREA AT  
KATHRYN ABBEY HANNA PARK, JACKSON-  
VILLE, FLORIDA,**  
Geological Survey, Tallahassee, Fla.

G. W. Leve, and M. I. Backer.

Administrative Report, 1976. 27 p., 6 fig., 4 tab.

Descriptors: \*Lakes, \*Hydrogeology, \*Water quality, \*Aquifers, \*Florida, Parks, Groundwater movement, Inflow, Shallow water, Surface waters, Chemical analysis, Water analysis, Hydrology.

Identifiers: Kathryn Abbey Hanna Park(Fla).

Kathryn Abbey Hanna Park, Fla., is underlain by a shallow aquifer and the Floridan aquifer. The shallow aquifer is composed of two water-yielding zones: the surficial sand and shell beds and the lower sand and shell beds. The water in the Floridan aquifer is lower in mineral concentration than water in the shallow aquifer. The chloride concentration in the Floridan aquifer is about 20 mg/litre and the dissolved-solids concentration is less than 500 mg/litre. Nine shallow lakes investigated in the park intersect the shallow aquifer. They are recharged directly by rainfall and probably by some inflow from the upper part of the shallow aquifer. The southernmost lake periodically receives inflow of saline water from the Intracoastal Waterway through a canal, and the water is more highly mineralized than in the other lakes. Construction of a control structure on the canal would prevent further inflow of water from the waterway and possibly prevent further fish kills in the lake. Two lakes are densely covered with duckweed, and the dissolved-oxygen concentration of the water ranges from 0.6 to 1.3 mg/litre during daytime hours. The quality of water probably can be improved by increasing the circulation of water in these lakes and by artificially recharging the lakes with water from the Floridan aquifer. (Woodard-USGS)  
W76-07602

**SPRINGS OF PENNSYLVANIA,**  
Geological Survey, Harrisburg, Pa.

H. N. Flippo, Jr.

Pennsylvania Department of Environmental Resources Harrisburg, Water Resources Bulletin No 10, December 1974. 46 p., 2 fig., 3 tab, 19 ref.

Descriptors: \*Springs, \*Discharge(Water), \*Water quality, \*Pennsylvania, Aquifers, Water analysis,

\*Chemical analysis, Data collections, Water pollution sources, Hydrogeology, Water utilization, Water supply, Evaluation.

Discharge and water-quality data, together with other information, are tabulated for 196 selected springs in Pennsylvania. These springs represent discharges of several principal aquifers; however, about half of them flow from Cambrian and Ordovician limestones and dolomites, which give rise to about 90 percent of all springs having discharges in excess of 100 gpm. The large springs are utilized for fish hatcheries, municipal supplies, and other purposes, because of their relatively good quality characteristics. Eleven of the carbonate-aquifer springs discharge 5,000 to 20,000 gpm. The largest spring, on the basis of median discharge, is Nippono (Enchanted) Spring in Lycoming County, which yields about 18,000 gpm. Some large springs are the discharge points of natural underground conduits that are principally fed by streams. The discharge and quality of water from these springs are variable. The quality of some springs has deteriorated in recent decades. High concentrations of sodium, potassium, chloride, nitrate, and fecal-coliform bacteria in recently sampled spring waters indicate contamination and, in some localities, pollution of the major aquifers. (Woodard-USGS)  
W76-07604

**THE EXTENDED BOUSSINESQ PROBLEM,**  
Southern Methodist Univ., Dallas, Tex. Inst. of Tech.

M. A. Collins.

Water Resources Research, Vol. 12, No. 1, p 54-56, February 1976. 5 fig., 1 ref.

Descriptors: \*Water table, \*Drains, \*Groundwater movement, Leakage, Groundwater recharge, Saline water-freshwater interfaces, Aquifers, Groundwater, Continuity equation, Dupuit-Forchheimer theory, Boundary processes, Potentiometric level, Equations, Islands, Depth.

Identifiers: \*Boussinesq equation, \*Groundwater mound, \*Parallel drains, \*Saline aquifers, Freshwater lenses, Semipervious layers.

The original Boussinesq problem of the decline of a groundwater mound between parallel drains was extended to include vertical leakage and recharge and cases of freshwater lenses in confined and unconfined saline aquifers. The solution of appropriate continuity equations with some imposed restrictions by variable separation resulted in three distinct flow depth configurations, which could be described analytically. Transient behavior in two of these cases is nonlinear but amenable to exact solution and can be delineated in a ( $\mu$  +  $\beta$ ,  $\sigma$  +  $\mu$ ) plane, where  $\beta$  and  $\sigma$  are leakage and recharge parameters and  $\mu$  is a separation constant. It was found that similarity solutions, one of which is the original Boussinesq solution, exist for both decreasing and increasing flow depths. Active and passive influences of boundary conditions were distinguished. Solutions were applied to the evaluation of saline water intrusion in some coastal zones of Long Island, New York. (Visocky - ISWS)  
W76-07786

**GEOLGY AND GROUND-WATER  
RESOURCES OF HETTINGER AND STARK  
COUNTIES, NORTH DAKOTA,**  
Geological Survey, Bismarck, N. Dak.

For primary bibliographic entry see Field 4B.  
W76-08043

**KARST AND PALEOHYDROLOGY OF CAR-  
BONATE ROCK TERRANES IN SEMIARID  
AND ARID REGIONS WITH A COMPARISON  
TO HUMID KARST OF ALABAMA,**  
Geological Survey, Reston, Va.

V. T. Stringfield, P. E. LaMoreaux, and H. E. LeGrand.

## Field 2—WATER CYCLE

### Group 2F—Groundwater

Alabama Geological Survey, University, Bulletin 105, 1974, 106 p., 28 fig., 92 ref.

Descriptors: \*Karst hydrology, \*Arid climates, \*Humid climates, \*Paleohydrology, Hydrologic aspects, Carbonate rocks, Karst, Environmental effects, Climatic data, Meteorological data, Foreign countries, Australia, Mexico, Africa, \*Alabama, Arizona, Reviews, Sinks, Caves. Identifiers: \*Climate effects on Karst.

The contrast in precipitation between humid and arid carbonate regions is reflected in the relative degrees to which karstification is now active in these types of regions. This report describes three carbonate-rock terranes in arid or semiarid regions (Kaibab plateau in Arizona, Nullarbor Plain on the south coast of Australia, and the Western Desert of Egypt) and compares them with terranes in more humid regions of the United States and with that in the northern part of the Yucatan Peninsula, Mexico. Carbonate-rock areas in Alabama, U.S.A., are described as representative of those in humid climates. Reconstruction of the geologic and hydrologic history of each arid carbonate region reveals that karstification has been preserved from earlier times when the climate was less arid. (Woodard-USGS)

W76-08044

**ARTIFICIAL RECHARGE THROUGH A WELL IN FISSURED CARBONATE ROCK, WEST ST. PAUL, MINNESOTA,**  
Geological Survey, St. Paul, Minn.  
For primary bibliographic entry see Field 4B.

W76-08046

**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES—TEXAS-GULF REGION,**  
Geological Survey, Austin, Tex.

E. T. Baker, Jr., and J. R. Wall.

Available from Superintendent of Documents, Government Printing Office, Washington, D. C., 20402, \$2.45 in paper copy. Professional Paper 813-F, 1976, 29 p., 5 fig., 3 plates, 4 tab., 100 ref.

Descriptors: \*Groundwater resources, \*Available water, \*Water quality, \*Regional analysis, \*Hydrologic data, Water supply, Water yield, Water storage, Aquifer characteristics, Water utilization, Water demand, Conjunctive use, Water resources development, Water rights. Identifiers: \*Texas-Gulf Region.

Groundwater in the Texas-Gulf Region is a large and important resource that can provide a more significant percentage of the total water supply of the region. Total water requirements within the region are projected to rise sharply from 14 million acre-ft (17 cubic kilometres) in 1970 to nearly 26 million acre-ft (32 cubic kilometres) in 2020. About half of the water used in 1970 was groundwater. An estimated total of 1.04 billion acre-ft (1,280 cubic kilometres) of recoverable water containing less than 3,000 mg/litre dissolved solids is stored above a depth of 400 ft (122 metres) in the aquifers of the region. In addition, part of an estimated 3.28 billion acre-ft (4,040 cubic kilometres) of water in storage below 400 ft (122 metres) is recoverable. Although not all of the groundwater in storage is recoverable, a significant amount is available for development; and an enormous quantity is accessible should occasions prompt its use on a time-limited basis. (Woodard-USGS)

W76-08051

**AVAILABILITY OF GROUND WATER FOR IRRIGATION ON THE KEKAHAMANA COASTAL PLAIN, ISLAND OF KAUAI, HAWAII,**  
Geological Survey, Honolulu, Hawaii.  
For primary bibliographic entry see Field 4B.

W76-08054

**RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER BASIN, WEST VIRGINIA,**  
Geological Survey, Morgantown, W. Va.  
For primary bibliographic entry see Field 4B.  
W76-08055

**GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI,**  
Geological Survey, Baton Rouge, La.  
J. N. Payne.

Available from Supt. of Documents, GPO Wash., D.C. 20402, price \$11.00. Geological Survey Professional Paper 569-D, 1975, 11 p., 2 fig., 9 plates, 1 tab., 60 ref.

Descriptors: \*Hydrogeology, \*Water quality, Lands, \*Lithification, \*Hydrologic data, Chemical analysis, Groundwater, Water wells, Arkansas, Louisiana, Texas, Mississippi, Maps, Aquifer characteristics, \*Sands.

Identifiers: \*Lithofacies, Carrizo Sand, Meridian Sand.

The study of the Carrizo and Meridian Sands is the fourth part of an investigation of the geohydrology of the Claiborne Group. The regional dip of the Carrizo and Meridian Sands is into the Desha basin, Mississippi embayment, and gulf coast geosyncline. Some movement of major structural features took place during Carrizo and Meridian time. Normal faulting is rather extensive in southern Arkansas and in Texas. The thickness of the Carrizo and Meridian Sands varies from 0 in areas of nondeposition to a maximum of 700-750 feet in De Witt and Karnes Counties, Tex. Aquifer tests indicate that the coefficient of permeability increases with increase in sand-unit thickness, but the range in values in the Carrizo and Meridian Sands is not as great as the range in values found in the other Claiborne aquifer formations. The areas of highest transmissivity of the formations are in west-central Mississippi and in southern Texas. In Mississippi and Texas the dominant anion is bicarbonate in water from the Carrizo and Meridian Sands from depths of 1,700 to more than 2,500 feet. In Arkansas and Louisiana, chloride is the dominant anion below depths of 500-1,000 feet. (Woodard-USGS)

W76-08061

## 2G. Water In Soils

**EVALUATION OF A SOIL NITRATE TRANS-PORT MODEL,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.  
For primary bibliographic entry see Field 5B.  
W76-07453

**TESTS OF THE CONCEPT OF SECONDARY FROST HEAVING,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agronomy.  
For primary bibliographic entry see Field 2C.  
W76-07558

**WATER MOVEMENT THROUGH SATURATED-UNSATURATED POROUS MEDIA: A FINITE-ELEMENT GALERKIN MODEL,**  
Oak Ridge National Lab., Tenn.  
For primary bibliographic entry see Field 2F.  
W76-07569

**THE EFFECT OF IRRIGATION ON THE DEVELOPMENT OF DESERT TAKYR SOILS, (IN RUSSIAN),**  
For primary bibliographic entry see Field 3F.  
W76-07580

**HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME III,**  
Ontario Inst. for Environmental Studies, Toronto.  
For primary bibliographic entry see Field 5A.  
W76-07676

**EFFECT OF SOIL MOISTURE AFTER YOUNG PANICLE FORMATION STAGE ON MINERAL COMPOSITION IN LOWLAND BROWN RICE, (IN JAPANESE),**  
National Food Research Inst., Tokyo, (Japan).  
For primary bibliographic entry see Field 3F.  
W76-07693

**COMPARISON OF LABORATORY AND FIELD DETERMINED SATURATED HYDRAULIC CONDUCTIVITY AND PREDICTION FROM SOIL PARTICLE SIZE,**  
University of the West Indies, St. Augustine (Trinidad). Dept. of Soil Science.  
F. A. Gumbs.  
Trop Agric. 51(3), p 375-382, 1974.

Descriptors: Analytical techniques, \*Instrumentation, \*Water table, \*Hydraulic conductivity, \*Measurement, Soil types, Particle size, Sands, Silts, Clays, \*Regression analysis.

A very simple apparatus is described for measuring saturated hydraulic conductivity (SHC) above a water table in the field. The horizontal component of SHC measured by laboratory and field techniques was studied at the 0-30 cm, 30-60 cm, 60-120 cm and 120-180 cm depths at 2 sites about 150 m apart on River estate sandy loam. The mean laboratory measured values were usually greater (by a factor of 1.5-15) than the field values and replicates were more variable. The soil profiles at the 2 sites differed in appearance and in particle size distribution and this latter influenced the SHC. SHC was significantly positively correlated with the coarse sand content and regression equations involving coarse sand content were good at predicting the SHC as measured in the field. The multiple regression equation of SHC with the four particle sizes (coarse sand, fine sand, silt and clay) had the highest variable proportion for regression but the F ratio was significant only at  $P = 0.05$ . The simple linear regression (SHC =  $0.62 + 0.11\% \text{ coarse sand}$ ) should be adequate for soil survey work and for calculating drain spacing. In this soil type SHC increased markedly as the bulk density decreased from 1.4 g/cm<sup>3</sup> (porosity of 48%). A bulk density of 1.4 g/cm<sup>3</sup> may be critical for adequate water relations in this soil type.—Copyright 1974, Biological Abstracts, Inc.

W76-07698

**THE WILTING POINT AND AVAILABLE MOISTURE IN TROPICAL FOREST SOILS OF NIGERIA,**  
Ife Univ. (Nigeria). Dept. of Soil Sciences.  
A. O. Obi.  
Exp Agric. 10(4), p 305-312, 1974.

Descriptors: \*Soil moisture, Moisture content, Africa, \*Wilting point, \*Forest soils, Tropical regions, \*Soil water, Crops, Greenhouses.  
Identifiers: \*Nigeria, Okra, Sunflower.

Availability of soil water was investigated and the methods of determining the lower limit of availability by biotic and standard 15-bar pressure were compared. Greenhouse-grown sunflower and okra were the test crops for the biotic method. The pressure membrane equipment was used for standard 15-bar moisture determination. Okra and sunflower took up water beyond the standard 15-bar tension, thus lowering the moisture content at moderate wilting below the generally accepted values. In topsoil okra wilted at very high tensions, but at somewhat lower tensions in subsoil samples, unlike sunflower which wilted at higher tensions in subsoil samples. An equation is given

## WATER CYCLE—Field 2

### Lakes—Group 2H

which may be used to estimate the moisture content at the moderate wilting point of plants with known wilting tensions.—Copyright 1975, Biological Abstracts, Inc.  
W76-0770

**DETERMINATION OF SOIL-WATER DIFFUSIVITY FOR ANISOTROPIC STRATIFIED SOILS.**  
Connecticut Agricultural Experiment Station, New Haven.  
B. L. Sawhney, J.-Y. Parlange, and N. C. Turner. Soil Science Society of America Journal, Vol. 40, No. 1, p 7-9, January-February 1976. 3 fig, 10 ref.

Descriptors: \*Soil moisture, \*Diffusion, \*Soil water movement, Soil physical properties, Soil properties, Soil water, Unsaturated flow, Subsurface water, \*Anisotropy, Laboratory tests, Infiltration.

Identifiers: \*Stratified soils.

The unsaturated soil-water diffusivity of an anisotropic soil can be described by a second-order tensor. In the particular case of a stratified soil, the diffusivity tensor is defined by the two values of the diffusivity in the principal directions, one normal and one parallel to the soil layer. The standard method of Bruce and Klute then requires the use of two soil columns, one for each direction, to define the diffusivity tensor. The present method made use of a two-dimensional similarity solution first derived for an isotropic medium and extended here to a stratified soil. It was then possible to obtain the diffusivity tensor of the stratified soil from one experiment only. As an illustration of the method, the diffusivity tensor of a mica layer was measured and the result was used to analyze infiltration from a finite trench. (Sims-ISWS)

W76-07767

**COMPARISONS OF CALCULATED AND MEASURED CAPILLARY POTENTIALS FROM LINE SOURCES,**  
Southern Piedmont Conservation Research Center, Watkinsville, Ga.  
A. W. Thomas, H. R. Duke, D. W. Zachmann, and E. G. Kruse. Soil Science Society of America Journal, Vol. 40, No. 1, p 10-14, January-February 1976. 4 fig, 2 tab, 11 ref.

Descriptors: \*Soil physical properties, \*Capillary action, \*Soil water movement, \*Irrigation, Capillary water, Soil moisture, Soil water, Infiltration, Hydraulic conductivity, Subsurface irrigation, Subsurface flow, Laboratory tests.

Calculated distributions of capillary potentials were compared with those measured in a soil bin designed to model the water distribution from a subsurface irrigation system. Capillary potentials were computed from mathematical equations developed to model steady infiltration from a distribution of line sources which lie in a horizontal plane and are parallel and equally spaced. Capillary potentials were measured from a steady flow regime created in a soil bin for two soils. This study has shown promise that the equations can predict the capillary potentials in most regions of a soil mass which is irrigated with a subsurface system. (Sims-ISWS)

W76-07768

**ASSESSMENT OF SOIL MOISTURE STORAGE FROM RAINFALL AND ITS UTILITY IN RABI CROP PLANNING IN HARYANA STATE,**  
Haryana Agricultural Univ., Hissar (India).

O. P. Bishnoi.

Indian Journal of Meteorology, Hydrology and Geophysics, Vol. 26, No. 1, p 97-100, January 1975. 4 fig, 5 tab, 6 ref.

Descriptors: \*Rainfall, \*Soil moisture, \*Crops, \*Dry farming, Moisture availability, Evaporation, Precipitation(Atmospheric), Climatology, Soil water, Soil-water-plant relationships, Farm management, Planting management.  
Identifiers: \*India.

gray-brown soils and solonchaks.—Copyright 1975, Biological Abstracts, Inc.  
W76-07964

**THE PHYSICO-CHEMICAL CHANGES OF NEWLY FLOODED SOILS,**  
Andhra Pradesh Univ., Hyderabad (India). Agricultural Research Inst.  
R. M. Badrinarayan, and J. Venkateswarlu. J Indian Soc Soil Sci. 22(1), p 13-18, 1974.

Descriptors: Soils, \*Flooding, \*Rice, Manganese, Phosphorus, \*Soil chemistry, Iron, Silica, Aluminum.

Changes occurring when soils were brought under low-land paddy for the 1st time were studied. A period of submergence of 2-3 wk appeared to be necessary for obtaining better dry matter production for rice grown under lowland conditions for the 1st time. Green manuring with 2-3wk of submergence further enhanced dry matter production. Submergence of the soils for the 1st time led to an Al concentration of 1.2 to 1.64 ppm which, if not removed through drainage, might be toxic to rice. Si in the leachate was sufficient under submergence for normal growth. The adsorbed Fe, Mg and P generally increased with the period of submergence.—Copyright 1975, Biological Abstracts, Inc.  
W76-07980

### 2H. Lakes

**PROCEEDINGS: SECOND WETLANDS CONFERENCE (HELD ON JANUARY 9, 1974 AT STORRS, CONNECTICUT),**  
Connecticut Univ., Storrs. Inst. of Water Resources.

For primary bibliographic entry see Field 6E.

W76-07451

**LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 17-3, LONGSHORE WAVE ENERGY ANALYSES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.

W76-07470

**DESIGN WAVE INFORMATION FOR THE GREAT LAKES, REPORT 1, LAKE ERIE,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
D. T. Resio, and C. L. Vincent. Technical Report H-76-1, January 1976. 148 p, 24 fig, 8 tab, 6 append, 68 ref.

Descriptors: \*Great Lakes, \*Lake Erie, \*Waves(Water), \*Wind velocity, Shores, \*Shore protection, Model studies.  
Identifiers: \*Design wave.

Hindcast wave information that is applicable to many planning and design purposes on Lake Erie is presented. Historical wind data from four stations along Lake Erie served as input to the numerical hindcast model, and significant wave heights were calculated for 5-, 10-, 20-, 50-, and 100-yr return periods. These results are provided in tabular form for 24 points along the Lake Erie shoreline. The mean significant period for each of these wave heights is also given. Information is provided for four seasons of the year (January-March, April-June, July-September, and October-December) and is separated into three approach directions relative to shore. (WES)  
W76-07473

## Field 2—WATER CYCLE

### Group 2H—Lakes

**OUTLET WORKS FOR TAYLORSVILLE LAKE, SALT RIVER, KENTUCKY; HYDRAULIC MODEL INVESTIGATION.**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07476

**DESIGN OF ENTRANCE CHANNEL IMPROVEMENTS FOR LUDINGTON HARBOR, MICHIGAN; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07477

**PERSISTENCE OF DIQUAT IN THE AQUATIC ENVIRONMENT,**  
Wisconsin Univ., Madison. Water Resources Center.  
For primary bibliographic entry see Field 5C.  
W76-07546

**INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES.**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
International Field Year for the Great Lakes (IFYGL) Bulletin No. 17, February 1976. 112 p, 9 fig, 10 tab.

Descriptors: \*Great Lakes, \*International waters, \*International Hydrological Decade, \*Canada, \*United States, \*Lake Ontario, Programs, Publications, Bibliographies, Water temperature, Currents(Water), Lakes.  
Identifiers: \*International Field Year for the Great Lakes.

Listed were the official International Field Year for the Great Lakes (IFYGL) publications, joint Canadian-U. S. publications included in IFYGL Bulletin No. 16, and additions to the IFYGL bibliography. Abstracts of nine Canadian-authored papers presented at the 17th Conference on Great Lakes Research in August 1974 were given. Information presented for Lake Ontario included monthly mean temperatures and monthly resultant lake currents for May through November. Brief reports on both Canadian and U. S. scientific projects were included. Canadian and U. S. summaries of data available from IFYGL archives were tabulated. (Sims-ISWS)  
W76-07563

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS TRIBUTARIES.**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07574

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS ILLINOIS TRIBUTARIES.**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07579

**FISH GROWTH RESPONSE TO MECHANICAL MIXING OF LAKE ARBUCKLE, OKLAHOMA,**  
Oklahoma Cooperative Fishery Unit, Stillwater.  
For primary bibliographic entry see Field 5C.  
W76-07587

**RECONNAISSANCE DATA ON LAKES IN WASHINGTON—VOLUME 2. KING AND SNOHOMISH COUNTIES,**  
Geological Survey, Tacoma, Wash.  
G. C. Bortleson, N. P. Dion, J. B. McConnell, and L. M. Nelson.  
Washington Department of Ecology, Olympia, Water-Supply Bulletin 43, Vol 2, 1976. 424 p, 1 fig, 13 ref.

Descriptors: \*Lakes, \*Lake morphology, \*Lake morphometry, \*Water quality, \*Washington, \*Data collections, Bathymetry, \*Aerial photography, Lake shores, Mapping, Water analysis, Physical properties, Chemical analysis.  
Identifiers: King County(Wash), Snohomish County(Wash).

A total of 156 lakes in King and Snohomish counties of western Washington was sampled using helicopter or boat to obtain information on lake physical, cultural, and water-quality conditions. Physical parameters were determined from topographic and bathymetric (bottom-contour) maps of the lakes. If bathymetric maps were not available, the lakes were sounded and charted using a continuous-recording fathometer. By use of aerial photographs and lake depths, the bathymetric data were digitized and transferred to computer cards which served as input to a computerized program that calculated lake morphometric parameters (for example, lake volume, surface area, and length of shoreline). Vertical profiles of temperature and dissolved oxygen were measured in the deepest part of each lake. Secchi-disc visibility was determined also. Water samples were collected for color, nutrient, and specific-conductance analyses at depths 3.0 feet below the water surface and 3-5 feet above the lake bottom. Samples for fecal-coliform bacteria were collected at selected nearshore sites, approximately 100 feet offshore at a depth of 1 foot below the water surface.  
(Woodard-USGS)  
W76-07591

**RECONNAISSANCE DATA ON LAKES IN WASHINGTON—VOLUME 1. CLALLAM, ISLAND, JEFFERSON, SAN JUAN, SKAGIT, AND WHATCOM COUNTIES,**  
Geological Survey, Tacoma, Wash.

G. C. Bortleson, N. P. Dion, J. B. McConnell, and L. M. Nelson.  
Washington Department of Ecology, Olympia, Water-Supply Bulletin 43, Vol 1, 1976. 248 p, 1 fig, 13 ref.

Descriptors: \*Lakes, \*Lake morphology, \*Lake morphometry, \*Water quality, \*Washington, \*Data collections, Bathymetry, \*Aerial photography, Lake shores, Mapping, Water analysis, Physical properties, Chemical analysis.  
Identifiers: Northwestern Washington lakes.

A total of 89 lakes in six counties (Clallam, Island, Jefferson, San Juan, Skagit and Whatcom) of northwestern Washington was sampled using helicopter or boat to obtain information on lake physical, cultural, and water-quality conditions. Physical parameters were determined from topographic and bathymetric (bottom-contour) maps of the lakes. If bathymetric maps were not available, the lakes were sounded and charted using a continuous-recording fathometer. By use of aerial photographs and lake depths, the bathymetric data were digitized and transferred to computer cards which served as input to a computerized program that calculated lake morphometric parameters (for example, lake volume, surface area, and length of shoreline). Vertical profiles of temperature and dissolved oxygen were measured in the deepest part of each lake. Secchi-disc visibility was determined also. Water samples were collected for color, nutrient, and specific-conductance analyses at depths 3.0 feet below the water surface and 3-5 feet above the lake bottom. Samples for fecal-coliform bacteria were collected at selected nearshore sites, approximately 100 feet offshore at a depth of 1 foot below the water surface.

a depth of 1 foot below the water surface.  
(Woodard-USGS)  
W76-07592

**GEOHYDROLOGY OF THE LAKE AREA AT KATHRYN ABBEY HANNA PARK, JACKSONVILLE, FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 2F.  
W76-07602

**CHEMICAL CHARACTERISTICS OF THE LOWER KISSIMMEE RIVER, FLORIDA—WITH EMPHASIS ON NITROGEN AND PHOSPHORUS,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5A.  
W76-07603

**LAKE ERIE, OHIO, PENNSYLVANIA, NEW YORK INTAKE WATER QUALITY SUMMARY 1972,**  
Environmental Protection Agency, Fairview Park, Ohio.  
For primary bibliographic entry see Field 5A.  
W76-07610

**CHARACTERIZATION OF LIMNETIC ZOOPLANKTON PHOSPHORUS EXCRETION AND FACTORS AFFECTING TEMPORAL EXCRETION RATES IN THE PHOSPHORUS CYCLE IN A LAKE,**  
New Hampshire Univ., Durham. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W76-07675

**SURVEILLANCE METHODOLOGY - 1974,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
For primary bibliographic entry see Field 5A.  
W76-07679

**A BOTTOM SEDIMENT TRAP FOR RECENT SEDIMENTARY DEPOSITS,**  
National Swedish Environment Protection Board, Uppsala. Limnological Survey.  
For primary bibliographic entry see Field 2J.  
W76-07766

**TEMPERATURE STEPS IN LAKE KIVU: A BOTTOM HEATED SALINE LAKE,**  
Massachusetts Inst. of Tech. Cambridge. Dept. of Earth and Planetary Sciences.  
F. C. Newman.  
Journal of Physical Oceanography, Vol. 6, No. 2, p 157-163, March 1976. 10 fig, 11 ref. ONR N00014-67-A-0204-0048, NSF A30729X.

Descriptors: \*Temperature, \*Saline lakes, \*Heated water, Salinity, Salts, \*Water temperature, Geothermal studies, On-site data collections, On-site investigations, Instrumentation, Interfaces, Lakes, Limnology, Profiles, Africa.  
Identifiers: \*Lake Kivu(Dem Rep of Congo-Rwanda).

Vertical profiles of temperature microstructure in Lake Kivu were obtained with 'mini-microstructure recorders' developed by C.S. Cox and William Johnson at Scripps Institution of Oceanography. The profiles revealed three depth intervals containing many isothermal layers typically 0.25-2 m thick and of increasing temperature increments 0.01-0.03 C from layer to layer. Approximately 150 such layers appeared in a single profile. Double-diffusive convection was assumed and the results of Huppert and of Turner were applied to calculate an upward heat flux of 0.71 to 1.6 W/sq m and a corresponding upward salt flux equal to one-fifth

## WATER CYCLE—Field 2

### Lakes—Group 2H

of the average salt output of the lake's only outflow. The chief source of heat and salt is probably geothermal springs in the lake bottom. (Sims-SWS)  
W76-07774

**PROCEEDINGS: LAKE TAHOE RESEARCH SEMINAR II, 27 SEPTEMBER 1974, SANDS VAGABOND CONVENTION CENTER, SOUTH LAKE TAHOE, CALIFORNIA,**  
Lake Tahoe Area Research Coordination Board  
South Lake Tahoe, Calif.  
For primary bibliographic entry see Field 5G.  
W76-07793

**THE SCIENTIST AND DECISION MAKING AT LAKE TAHOE,**  
For primary bibliographic entry see Field 6B.  
W76-07795

**CLEAN WATER FOR MID-AMERICA.**  
Federal Water Pollution Control Administration,  
Chicago, Ill. Great Lakes Region.  
For primary bibliographic entry see Field 5G.  
W76-07821

**REPRODUCTION OF THE BANDED KILLIFISH: FUNDULUS DIAPHANUS DIAPHANUS (LE SUEUR), (IN FRENCH),**  
Service Faune Auebec, St. Faustin. Station for  
Pisciculture.  
P. Fournier, and E. Magnin.  
Nat Can (Que) 102(2), p181-188, 1975.

Descriptors: \*Fish reproduction, \*Killifishes, Canada, Lakes, Fish population, Gonads.  
Identifiers: Banded fish, *Fundulus-Diaphanus-Diaphanus*.

The relationship between gonad weight and total body weight for the female banded killifish *F. diaphanus* (Le Sueur), indicates that postpawning egg development is slow until spring. With increasing water temperatures in early June, the weight of ovaries and testicles increases rapidly until the spawning season, 6 wk. later. All males and most females in Lakes Saint-Louis and Renaud (Canada) are mature when 2 yr old. Sexual maturity appears to be a function of size rather than age. The minimum lengths at which female banded killifish produced mature eggs, in lakes Saint-Louis and Renaud, were 42 mm and 47 mm, respectively. Females comprise 75% of the population in Lake Saint-Louis and 55% in Lake Renaud. Spawning occurs in both lakes in July lasting a minimum of 3 wk when water temperatures range from 21-23°C.—Copyright 1975, Biological Abstracts, Inc.  
W76-07937

**PRODUCTION OF A SEMI-VOLTINE CHIRONOMID, CHIRONOMUS COMMUTATUS STR. IN LAKE PORT-BIELH (CENTRAL PYRENEES), (IN FRENCH),**  
Toulouse-3 Univ. (France). Laboratoire d'Hydrobiologie.  
H. Laville.  
Ann Limnol 11(1), p 67-78, 1975.

Descriptors: Lakes, Productivity, Europe, Biomass, \*Crustaceans, Brown trout.  
Identifiers: Chironomus-Commatus, Port-Bielh, Pupation, Pyrenees, *Salmo-Trutta-Fario*, Semivoltine.

The net annual production of *C. commutatus* was estimated in 1971-72 as 6.29 kg/ha/dry weight, 2nd in importance in the production of the littoral-profundal benthic community of the Lake (in France). The value of the ratio P/B<sub>max</sub> (production/maximum biomass) = 1.49 confirms the stability of this ratio, a stability which has been previously shown for several representatives of the benthos and more recently for 2 monocyclic

species of Crustacea from the same lake. Of the production, 36% is lost by the ecosystem during the pupation (30%) and emergence of the adults (6%). Brown trout (*Salmo trutta fario*) utilize 10.5% of the production of *C. commutatus* when they feed on the ascending pupae; this represents 49 kg/wet weight for the 10.5 ha of the zone between the depths of 7-19 m. — Copyright 1975, Biological Abstracts, Inc.  
W76-07939

**BRIEF MICROBIOLOGICAL CHARACTERIZATION OF THE KAYRAKKUM RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk Tadzhikskoi SSR, Dushanbe. Institut Zoologii i Parazitologii.  
For primary bibliographic entry see Field 5C.  
W76-07941

**PHYTOPLANKTON OF THE VLASINA LAKE DURING THE PERIOD 1949-1964, (IN SERBO-CROATIAN),**  
Institute for Biological Research, Belgrade (Yugoslavia).  
D. Milovanovic.  
Arh Biol Nauka 25(3/4), p 177-194, 1973(1975).

Descriptors: \*Phytoplankton, Lakes, Europe, Bogs.  
Identifiers: Sphagnum bogs, \*Yugoslavia(Vlasina Lake).

The process of formation of Vlasina Lake (Yugoslavia) in a widely extended sphagnum bog, was studied from early 1949 to the end of 1964. The changes in the physico-chemical water regime and in the formation of phytoplankton populations were established during this 16-yr period.—Copyright 1975, Biological Abstracts, Inc.  
W76-07942

**A CHARACTERISTIC OF THE LAKES OF THE LECZYNSKO-WLODAWSKIE LAKE DISTRICT BASED ON ABIOTIC ENVIRONMENTAL FACTORS, (IN POLISH),**  
Marie Curie-Sklodowska Univ., Lublin (Poland). Inst. of Biology.  
For primary bibliographic entry see Field 5C.  
W76-07943

**HYDROBIOLOGICAL CONDITION IN THE RESERVOIR-COOLER OF THE LITHUANIAN STATE REGIONAL ELECTRIC POWER STATION, (IN RUSSIAN),**  
Akademiya Nauk Litovskoi SSR, Vilnius. Institut Zoologii i Parazitologii.  
For primary bibliographic entry see Field 5C.  
W76-07944

**THE PRODUCTIVITY OF THE WATERS OF MAR GRANDE AND MAR PICCOLO OF TARANTO (1962-1969), (IN ITALIAN),**  
For primary bibliographic entry see Field 2L.  
W76-07947

**PARTICULARS OF SOME SPECIMENS OF ALGAL FLORA OF THE PONDS OF BERRE AND VAINE (BOUCHES-DU-RHONE), (IN FRENCH),**  
Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Vegetale.  
For primary bibliographic entry see Field 5C.  
W76-07950

**THE GRADIENT OF SALINITY, ITS SEASONAL MOVEMENT, AND ECOLOGICAL IMPLICATIONS FOR THE LAKE IZABAL-RIO DULCE ECOSYSTEM, GUATEMALA,**  
Florida Univ., Gainesville. Dept. of Botany.  
For primary bibliographic entry see Field 5C.  
W76-07975

**MODEL STABILITY, RESILIENCE, AND MANAGEMENT OF AN AQUATIC COMMUNITY,**  
Washington State Univ., Pullman. Dept. of Zoology.  
G. E. Long.  
Oecologia (Berl). 17(1), p 65-86, 1974.

Descriptors: \*Model studies, \*Algae, Population, \*Aquatic populations, Stability, Management, Lakes, Environmental effects, \*Biological communities, \*Ecosystems, Nitrogen, Potassium.

Identifiers: *Daphnia-Galeata*, Resilience, Verhulst-Pearl logistic model.

A community model may be considered stable when, the absence of exogenous variation, all population trajectories encircle or asymptotically approach equilibrium. Community models in which, in the absence of analytical indications of stability, all populations either exhibit trajectories toward equilibrium or possess properties such that departures from equilibrium are inhibited, will be defined as resilient. The necessary properties include appropriate sensitivity (i.e., the total derivative,  $df_i/dV_j$ , of the  $i$ th species function,  $f_i = dN_i/dt$ , with respect of the  $j$ th variable) to exogenous variables. A real, though simplified, ecological system consisting of *Daphnia galeata* and its algal food source in an oligotrophic lake appears to be generally resilient in that changes in the exogenous factors nitrate concentration and temperature of the lake water consistently restrain the departure of predicted population densities from equilibrium. Each population in the community is represented by the Verhulst-Pearl logistic model of population growth augmented to include environmental effects on rate of increase,  $r$ ; carrying capacity,  $K$ ; and the effects of predation on population density,  $N$ ; and therefore the population rate of change,  $dN/dt$ . Such community submodels and sensitivity analysis represent logical and appropriate amplifications in the use of mathematical models in the management of populations.—Copyright 1975, Biological Abstracts, Inc.  
W76-07976

**THE MERCURY CONTENTS OF FISH FROM CARINTHIAN LAKES, (IN GERMAN),**  
Bundesanstalt fuer Virusseuchenbekämpfung der Haustiere, Vienna (Austria).  
For primary bibliographic entry see Field 5C.  
W76-07981

**BIOLOGY OF THE CARP IN THE MINGECHAUR RESERVOIR, (IN RUSSIAN),**  
M. M. Seid-Rzaev.  
Izv Akad Nauk Az SSR Ser Biol Nauk 5-6, p 94-99, 1974.

Descriptors: \*Carp, Reservoir, Growth rates, Fish reproduction, Fish eggs, Fish populations.  
Identifiers: Azerbaijan-SSR, \*USSR(Mingechaur Reservoir).

Carp in the Mingechaur Reservoir on the Kura River in the Azerbaijan SSR (USSR) reach a length of 70.0 cm and weight of 8040 g. Fish 35-35 cm long and weighing 922-1768 g comprise the bulk of the fish caught. The age of the sexually mature carp varies from 3-10 yr; fish 4-5 yr old predominate in the catch. Since the construction of the reservoir in 1955, significant changes have not occurred in the structure of the carp population. The carp of the Mingechaur Reservoir lag in growth rate behind the carp of other water bodies of the Azerbaijan SSR. The fecundity of the carp averages 144,500 eggs.—Copyright 1975, Biological Abstracts, Inc.  
W76-07987

**PHENOLOGY AND PRODUCTIVITY OF PISTIA STRATIOTES L. ON THE VOLTA LAKE, GHANA,**  
Ghana Univ., Legon. Dept. of Botany.  
For primary bibliographic entry see Field 5C.

## Field 2—WATER CYCLE

### Group 2H—Lakes

W76-08036

**LONG-TERM CHANGES IN THE PLANKTON OF LAKE TYRIFJORD, NORWAY,**  
Kongelige Norske Videnskabers Selskab, Trondheim. Museet.  
A. Langeland.  
Norw J Zool. 22(3), p 207-219, 1974.

Descriptors: Lakes, \*Phytoplankton, Europe, Zooplankton, Daphnia, Algae, Diatoms, Rotifers, Seasonal.

Identifiers: Cyclops-scutifer, Daphnia-cristata, Diatomae, Fragilaria-crotonensis, Limnocalanus-macrurus, Mesocyclops-leuckarti, Mesocyclops-oithonoides, \*Norway(Lake Tyrifjord), Oscillatoria-rubescens.

Phyto-and zooplankton investigations were carried out in the freshwater Lake Tyrifjord, Norway, from 1957-1973, and the results compared with plankton investigations made in 1930. The phyto-and zooplankton communities had changed both quantitatively and qualitatively, the most important changes being an increased standing crop and biomass of Diatomae algae and rotifers, decreased occurrence in summer of Limnocalanus macrurus and the likely introduction of new phyto- and zooplankton species such as Oscillatoria rubescens, Fragilaria crotonensis, Daphnia cristata, Cyclops scutifer, Mesocyclops leuckarti and Mesocyclops oithonoides. The present ecological conditions in Lake Tyrifjord may be interpreted as a stage in an incipient eutrophication of the lake. -- Copyright 1975, Biological Abstracts, Inc.

W76-08042

**OCCURRENCE AND OUTFLOW OF ZOOPLANKTON IN THE KIEV RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk URSR, Kiev. Institut Hidrobiologii.  
For primary bibliographic entry see Field 5C.  
W76-08090

### II. Water In Plants

**EFFECT OF FLOODING ON THE REGENERATION OF SIX TROPICAL GRASSES AFTER DEFOLIATION,**  
Department of Primary Industries, Brisbane (Australia). Soil Conservation Branch.  
For primary bibliographic entry see Field 4A.  
W76-07696

**A HYDRODYNAMIC APPROACH TO THE MICROR DISTRIBUTION OF BENTHIC INVERTEBRATES IN RUNNING WATER, (IN FRENCH),**  
Toulouse-3 Univ. (France). Laboratoire d'Hydrobiologie.  
H. Decamps, G. Larrouy, and D. Trivellato.  
Ann Limol 11(1), p 79-100, 1975.

Descriptors: \*Invertebrates, Benthos.  
\*Distribution, Europe, Larvae, Streams.  
Identifiers: \*Simuliidae, \*France.

The microdistribution of larvae and pupae of 3 spp. of Simuliidae (*Odagmia variegata*, *O. obreptians* and *Simulium repicolum*) was observed in different streams in the Pyrenees (France). These species occur where there is high water velocity which, in the streams studied, was present in zones with torrential discharge. They were not found in zones with a general fluvial discharge. Smooth stones with a diameter greater than about 10 cm are the most frequently colonized substrata. The surfaces facing upstream and slightly inclined carry the greatest densities of larvae. In fast flowing zones with a longitudinal gradient of reduction in velocity, the larvae are concentrated in a narrow band where the velocity

is highest. The body of the larva lies in a downstream direction and moves with the pulsations of the current. The larvae of Simuliidae rapidly colonize channels immersed in the stream and it is possible to decline the hydrological conditions at the places where the larvae are attached. The flow varies with time at the same station and the discharge can change from a fluvial type to a torrential type. The profile of currents at the surface (in the zone where the invertebrates are living) can be determined as a function of the relative roughness of the surface. The presence of a laminar film (laminar sub-layer) depends upon the strength of the current and the unevenness of the substratum. For a given current speed, the relationship between the thickness of the laminar film and the index of roughness or unevenness affects the possible formation of a laminar film. The variation in the thickness of the laminar film is a function of current speed. The laminar film has only a small influence on the living conditions of larvae of Simuliidae; turbulence is an important factor. -- Copyright 1975, Biological Abstracts, Inc.

W76-07938

**INCIDENCE OF THE TERRESTRIAL COMMUNITIES ON THE SEASONAL REPRODUCTION OF THE TROGLOBIOTIC AMPHIPOD: NIPHARGUS, (IN FRENCH),**  
Lyon-1 Univ., Villeurbanne (France). Laboratoire de Biologie Sauter.

M. J. Turquin.  
Bull Soc Zool Fr 100(2), p 169-176, 1975.

Descriptors: \*Invertebrates, Ponds, Amphipoda, \*Reproduction, Seasonal, Caves.

Identifiers: \*Flies, \*Niphargus, Troglobites.

Terrestrial invertebrates periodically dropping into pools represent a large food input for the aquatic community of Hautecourt cave (France). The caloric value for flies alone was 300,000 calories (gm-cal)/yr/90m<sup>2</sup> of water. This 'manna' may be a new trigger for seasonal reproduction in aquatic troglobites. -- Copyright 1975, Biological Abstracts, Inc.

W76-07940

**CHANGES IN THE MICROPHYTOECENOTIC COMPOSITION OF QUACK GRASS MEADOWS IN THE FLOOD PLAIN OF THE LOWER DON IN DIFFERENT YEARS, (IN RUSSIAN),**  
Kalmky State Univ., Elista (USSR).  
V. A. Bananova, and B. N. Gorobachev.  
Bot Zh (Leningr) 60(3), p 432-437, 1975.

Descriptors: \*Flood plains, \*Grasses, Succession.  
Identifiers: Agropyron-Repens, Beckmania-Eruciformis, Phytocenotic composition, Quack grass, \*USSR(Don River).

A 3-yr study of quack grass (*Agropyron repens*) meadows in the floodplain of the lower Don (USSR) established that the microphytocoenotic structure of the quack grass meadow changes markedly depending on the presence or absence of floods. Of the 31 microassociations noted on this meadow, only 8 were found in all years of observation, the others existed only for 1 or 2 yr. In the flood year (1970) the composition of the quack grass association included more hydrophytic slough grass (*Beckmania eruciformis*); quack grass microphytocoenoses (microcommunities), and in floodless years their area first contracted, then disappeared from the grass stand. The relationship between species in the same microassociation also changed. On the basis of the changes of the microphytocoenotic composition of associations in different years it is possible to determine the direction of succession. -- Copyright 1975, Biological Abstracts, Inc.

W76-07953

**RESISTANCE TO WATER FLOW IN SOIL AND PLANTS, PLANT WATER STATUS STOMATAL**

**RESISTANCE AND TRANSPIRATION OF ITALIAN RYEGRASS, AS INFLUENCED BY TRANSPIRATION DEMAND AND SOIL WATER DEPLETION,**  
Royal Veterinary and Agriculture Co., Copenhagen (Denmark). Hydrotechnical Lab.  
G. K. Hansen.

Acta Agric Scand. 24(2), p 83-92, 1974.

Descriptors: \*Plant-water-soil relationships, \*Water requirements, \*Transpiration, Resistance, \*Grasses, Soil physics.

Identifiers: Italian ryegrass, Lolium-Multiflorum, \*Plants, \*Rye grass.

Influence of water stress and transpiration demand on relative water content, resistance to water flow in soil and plants, stomatal resistance and transpiration of Italian ryegrass (*Lolium multiflorum*) was studied in growth chambers. The pooled resistance to water flow in soil and plants,  $R_s + R_p$ , determined as the ratio between the water potential drop from soil to leaves and transpiration, was analyzed. Resistance to water flow in soil,  $R_s$ , was estimated based on theories of soil physics. Assuming one-tenth, one-fifth and the entire root system acting as an effective sink for water,  $R_s$  showed no agreement with the determined  $R_s + R_p$ . Correction for  $R_s$  for a soil-root interface resistance dependent on soil-water content did not result in any agreement either.  $R_s$  at the actual root densities (18 cm cm<sup>-3</sup>) was not limiting within a range of 0.1-15 bars of soil-water potential (psi s). The relation was independent of the variation in the water potential drop whether it was obtained by change in transpiration demand or by change in soil-water content. The resistance of plants,  $R_p$ , decreased with increasing flow rate. No unique relation between  $R_p$  and leaf-water potential was found. Stomatal resistance,  $r_s$ , and transpiration during water stress, related to that of non-stressed plants,  $T$  Tm<sup>-1</sup>, decreased steeply when  $\psi_1$  decreased further below -11 bars. Linear correlation between  $r_s$  and  $T$  Tm<sup>-1</sup> was found. -- Copyright 1974, Biological Abstracts, Inc.

W76-07958

**THE CHEMICAL COMPOSITION OF ASPARAGUS SHOOTS AS Affected BY SOIL MULCHING, (IN ROMANIAN),**  
Institutul Agronomic, Bucharest (Rumania).

R. Ciocu.  
Lucr Stiint Inst Agron Nicolae Balcescu Bucur Ser B 15, p 309-314, 1972.

Descriptors: \*Asparagus, \*Plant growth, Vegetable crops, \*Mulching, Effects, \*Crop response, Amino acids.

Identifiers: Film mulch, Leaf mulch, Sawdust mulch.

The influence of film, sawdust and leaf mulching on the composition of the roots and shoots of asparagus (dry matter, soluble sugar, starch, crude protein, free amino acids, vitamin C) was investigated. Film mulching led to higher yields and better shoot quality. -- Copyright 1975, Biological Abstracts, Inc.

W76-07968

**MODEL STABILITY, RESILIENCE, AND MANAGEMENT OF AN AQUATIC COMMUNITY,**  
Washington State Univ., Pullman. Dept. of Zoology.

For primary bibliographic entry see Field 2H.  
W76-07976

**DYNAMICS OF THE ANNUAL GROWTH OF PINUS SYLVESTRIS L. IN THE TURGAI VALLEY IN CONNECTION WITH CLIMATIC FACTORS, (IN RUSSIAN),**  
Kustanay Pedagogical Institut (USSR).

P. G. Pugachev.  
Bot Zh (Leningr) 60(3), p 401-412, 1975.

## WATER CYCLE—Field 2

### Erosion and Sedimentation—Group 2J

Descriptors: \*Scotch pine trees, Growth rates, Ecology, Climates, \*Dendrochronology, Forests. Identifiers: Kazakh-SSR, Steppe, \*USSR(Turgai Valley).

A dendroclimatic investigation of the growth of Scotch pine (*P. sylvestris*) of the insular pine forests in the Turgai valley in the Kazakh SSR (USSR) showed a direct relationship between annual growth and the ecological conditions in different climatic zones, from the forest-steppe to the semidesert. In the vegetation period the amount of precipitation in June-July has a decisive effect on the width of the annual rings of trees. In individual periods certain relationships between growth anomalies and a central form of atmospheric circulation are manifested for pine under steppe and desert conditions. Cycles of 9-11 yr were noted in the long-term growth of pine forests in the dry steppe-semidesert zone; 22-yr growth cycles were noted in trees of the more northern, steppe pine forests.—Copyright 1975, Biological Abstracts, Inc.

W76-07984

#### DIATOMS OF SOME MINERAL AND THERMAL SPRINGS IN THE CAUCASUS, (IN RUSSIAN), Leningrad State Univ. (USSR).

N. I. Golovenkina.

Vestn. Leningr Univ Biol 1, p 40-47, 1975.

Descriptors: \*Diatoms, \*Mineral water, \*Hot springs, Water temperature. Identifiers: \*USSR(Caucasus).

Diatoms in mineral and thermal springs with the encountered. The upper temperature of 19-54°C were studied: 120 spp. and varieties were encountered. The upper temperature limit of their development in the springs was 38°C. Dependence of the species diversity of diatoms on the temperature regime of the spring is established.

W76-07986

#### EVIDENCE FOR THE SIGNIFICANCE OF CRASSULACEAN ACID METABOLISM AS AN ADAPTIVE MECHANISM TO WATER STRESS, Bot. Inst., Fac. Biol. Tech. Hoch., Darmstadt, W. Ger.

K. Winter.

Plant Sci Lett. 3(4), p 279-281, 1974.

Descriptors: \*Metabolism, \*Photosynthesis, Nutrients, \*Plant growth, \*Growth rates, Temperature, Plant physiology. Identifiers: Crassulacean-Acid, \*Mesembryanthemum-Crystallinum.

Mesembryanthemum crystallinum plants exhibiting C3 pathway of photosynthesis were subjected for 3 wk to nutrient solution of low temperature (10) to reduce the absorption of water. By this stress treatment plant growth was largely retarded and Crassulacean Acid Metabolism (CAM) of photosynthesis was induced.—Copyright 1975, Biological Abstracts, Inc.

W76-08080

#### THE USE OF OVERWINTER DRAW DOWN FOR AQUATIC VEGETATION MANAGEMENT, Wisconsin Univ. Extension, Madison. Environmental Resources Unit.

S. A. Nichols.

Water Resources Bulletin, Vol. 11, No. 6, p 1137-1148, December 1975. 5 fig, 6 tab, 8 ref.

Descriptors: \*Drawdown, \*Winter, \*Aquatic plants, \*Management, Water quality, Nutrients, Wisconsin, Sampling, Chemical analysis, Vegetation, Fish, Water levels.

Identifiers: Water depth, Stem flow, Mondeau flowage, *Zizania aquatica*.

Overwinter drawdown can be a useful technique for aquatic plant management. Its effectiveness depends largely on the susceptibility of nuisance species to drawdown. A single overwinter drawdown provided good control of aquatic plants in a flowage dominated by *Potamogeton robbinsii*. Little additional control was gained by a second drawdown the following winter. Rapid reinvasion of plants after drawdown ceased dictates continued management. To avoid fish kills caused by low dissolved oxygen levels, caution is advised when using overwinter drawdown. The growth of *Zizania aquatica* was not negatively influenced by drawdown. The influence on water quality of nutrient release from decaying vegetation and exposed bottom sediments was uncertain. (Bell-Cornell)

W76-08093

#### 2J. Erosion and Sedimentation

##### DESIGN WAVE INFORMATION FOR THE GREAT LAKES, REPORT 1, LAKE ERIE, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 2H.

W76-07473

##### TOPOGRAPHIC EXPRESSION OF SUPERIMPOSED DRAINAGE ON THE GEORGIA PIEDMONT, Georgia State Univ., Atlanta. Dept. of Geology.

A. C. Staheli.

Geological Society of America Bulletin, Vol. 87, No. 3, p 450-452, March 1976. 4 fig, 6 ref.

Descriptors: \*Geomorphology, \*Topography, \*Drainage patterns(Geologic), \*Georgia, Streams, Stream erosion, Coastal plains, Sediments, Geology, Drainage, Sediment transport, Headward erosion.

Identifiers: \*Georgia Piedmont, Brevard zone, Stream capture, Sedimentary deposition.

The Brevard zone separates two regions on the Georgia Piedmont that have different drainage styles. Streams on the northwestern Piedmont have trellis drainage, which suggests that they have undergone a different evolution than streams that have dendritic drainage, on the southeastern Piedmont. It was concluded that Coastal Plain sediment covered the southeastern Georgia Piedmont to at least the Brevard zone. Consequent streams developed a dendritic drainage on this cover and became superimposed across buried resistant northeast-trending geologic structures. Trellis drainage, however, developed as a result of subsequent streams being controlled by Piedmont structures on areas of thin or no Coastal Plain sediment cover. (Lee - ISWS)

W76-07553

##### ESTABLISHMENT OF VEGETATION FOR SHORELINE STABILIZATION IN GALVESTON BAY, Texas A and M Univ., College Park, Dept. of Range Science.

For primary bibliographic entry see Field 2L.

W76-07567

##### ENVIRONMENTAL ASPECTS OF RUN-OFF AND SILTATION IN THE ANACOSTIA BASIN FROM HYPERALTITUDE PHOTOGRAPHS, Maryland Univ., College Park.

For primary bibliographic entry see Field 4D.

W76-07568

##### MEASUREMENT AND PREDICTION OF SEDIMENT YIELDS IN WISCONSIN STREAMS, Geological Survey, Madison, Wis.

S. M. Hindall.

Available from the National Technical Information Service, Springfield, Va 22161, as ADA-022 059, \$4.00 printed copy; \$2.25 microfiche. Water-Resources Investigations 54-75, January 1976. 27 p, 6 fig, 4 tab, 22 ref.

Descriptors: \*Sediment transport, \*Sediment yield, \*Wisconsin, \*Streams, Suspended load, Gaging stations, Data collections, Particle size, Bed load, Equations, Streamflow forecasting, Methodology.

Identifiers: \*Ungaged sites, \*Sediment yield forecasting.

Sediment data have been collected by the U.S. Geological Survey at 118 streamgaging sites throughout Wisconsin beginning in 1935. Enough data were collected at 84 of these sites to calculate average annual suspended-sediment transport. Measured average annual yields range from about 680 tons per square mile (238 tonnes per square kilometre) in the "Driftless Area" to 3.1 tons per square mile (1.1 tonnes per square kilometre) in the Northern Highland province. The average suspended-sediment yield for Wisconsin is about 80 tons per square mile per year (38 tonnes per square kilometre per year). Sediment-yield prediction equations for four geographic provinces make it possible to predict average annual sediment yield at any point on 95 percent of the streams in the State. The prediction technique involves regression equations that relate average annual suspended-sediment yields to the controlling physical factors. The standard error of estimate for these four equations, which only represent the accuracy of an estimated sediment yield at an ungauged site, ranges from 28 to 38 percent. (Woodard-USGS)

W76-07600

##### A BOTTOM SEDIMENT TRAP FOR RECENT SEDIMENTARY DEPOSITS, National Swedish Environment Protection Board, Uppsala. Limnological Survey.

L. Hakanson.

Limnology and Oceanography, Vol. 21, No. 1, p 170-174, January 1976. 5 fig, 12 ref.

Descriptors: \*Sedimentation, \*Sedimentation rates, \*Lakes, Deposition(Sediments), Sediment distribution, Sediment load, Settling velocity, Sedimentology, Sediments, Sampling, Equipment, Limnology.

Identifiers: \*Sediment traps, Sediment samplers.

A bottom trap for collection of recent sedimentary deposits has been constructed and field tested. The technique provides material deposited within a known time span, unaffected by bioturbation in the upper biologically active sediment layer. The trap has an area of 1541 sq cm and an edge height of 5 cm. Before retrieval, a lid is lowered onto the trap. The apparatus is easy to handle and has yielded representative values for the rate of deposition. (Sims-ISWS)

W76-07766

##### SOURCE, TRANSPORTATION AND DEPOSITION OF DEBRIS ON ARAPAHO GLACIER, FRONT RANGE, COLORADO, U.S.A., Colorado Univ., Boulder. Dept. of Geological Sciences; and Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.

For primary bibliographic entry see Field 2C.

W76-07777

##### SEASONAL REVERSAL OF FLOOD-TIDE DOMINANT SEDIMENT TRANSPORT IN A SMALL OREGON ESTUARY, Oregon Univ., Eugene. Dept. of Geology.

For primary bibliographic entry see Field 2L.

W76-07783

## Field 2—WATER CYCLE

### Group 2J—Erosion and Sedimentation

**COASTAL EROSION HAZARD IN THE UNITED STATES: A RESEARCH ASSESSMENT.**  
Rutgers - The State Univ., New Brunswick, N.J.  
For primary bibliographic entry see Field 2L.  
W76-07788

#### ERODIBILITY OF TAHOE SOILS,

M. Singer.

In: Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sands Vagabond Convention Center, South Lake Tahoe, California. Report No. NSF/RA/G-74-012, p 79-88.

Descriptors: \*Erosion, \*Sedimentation, \*Accelerated erosion, Forests, Mountains, Soil erosion, Erosion rates, Sediment yield, Slopes, Precipitation(Atmospheric), Simulated rainfall.  
Identifiers: \*Lake Tahoe(Nev-Calif).

The erosion program at Tahoe has three major focuses: (1) to measure actual amounts of erosion occurring on different kinds of soil, (2) to determine actual erodibility of soils, and (3) to trace the sources of sediments found in streams. Plots were established at seven sites on seven different soil series. The plots were 50 feet long and 6 feet wide, surrounded on three sides by redwood borders which were buried in the soil and extend a bit above the soil surface so that just erosion and just sediment movement within those borders could be measured. At the bottom end of the plots a pit was dug and lined with a cloth so that the sediment could be caught and weighed after different storm events. Rainfall on each of the sites was measured. The data from the plots were used to develop mathematical models to predict erosion. The basic chemical and physical properties of the different kinds of soils found in the Tahoe Basin were used to trace sediments from their source to the lake. (See also W76-07793) (Sims - ISWS)  
W76-07799

**WATER RESOURCES DATA FOR COLORADO, 1974: PART 2. WATER QUALITY RECORDS,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 7C.  
W76-08047

## 2K. Chemical Processes

**TRACE ELEMENTS IN SURFACE WATERS OF THE KARAGANDA OBLAST, (IN RUSSIAN),**  
E. A. Sologonikova.  
Izv Akad Nauk Kaz SSR Ser Biol. 1, p 48-51, 1974.

Descriptors: \*Trace elements, Surface waters, Copper, Zinc, Cobalt, Boron, Iodine, Manganese, Irrigation, Water sources, Molybdenum.  
Identifiers: \*USSR(Karaganda Oblast).

Surface waters (river, lakes, reservoirs) of the Karaganda Oblast, Kazakh SSR, USSR were investigated for their content of Cu, Zn, Mn, Co, Mo, B and I. The quantity of trace elements in them permitted the conclusion that the waters are completely suitable for drinking and irrigation. In the case of a deficiency of trace elements in soils and forage plants the water sources with such a content of these elements do not make up for their deficit in soils and forage. The content of trace elements in 39 water sources are given.--Copyright 1975, Biological Abstracts, Inc.  
W76-07528

**PITTSBURGH RAINWATER ANALYSIS BY PIXE,**  
Pittsburgh Univ., Pa.  
For primary bibliographic entry see Field 5A.  
W76-07555

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07570

**AVAILABILITY OF GROUND WATER IN THE PEMIGEWASSET AND WINNIPESAUKEE RIVER BASINS, CENTRAL NEW HAMPSHIRE,**  
Geological Survey, Concord, N. H.  
For primary bibliographic entry see Field 7C.  
W76-07589

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07571

**REFERENCE GUIDE TO METHODOLOGY FOR THE ANALYSIS OF ORGANIC COMPOUNDS,**  
Geological Survey, Bay St. Louis, Miss.  
For primary bibliographic entry see Field 5A.  
W76-07590

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 3 - DES PLAINES RIVER BASIN,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07572

**WATER RESOURCES OF PIERCE COUNTY, NEBRASKA,**  
Nebraska Univ., Lincoln. Conservation Co and Div.  
For primary bibliographic entry see Field 4A.  
W76-07598

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07573

**WATER-RESOURCES RECONNAISSANCE OF ST. GEORGE ISLAND, PRIBILOF ISLANDS, ALASKA,**  
Geological Survey, Anchorage, Alaska.  
For primary bibliographic entry see Field 4A.  
W76-07601

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07575

**CHEMICAL CHARACTERISTICS OF THE LOWER KISSIMMEE RIVER, FLORIDA--WITH EMPHASIS ON NITROGEN AND PHOSPHORUS,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 5A.  
W76-07603

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07576

**DETECTION OF TRACE PHOSPHORUS IN NATURAL WATERS BY GRAPHITE OVEN FLAME ANALYSIS,**  
Georgia Univ., Athens. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W76-07672

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA - VOLUME 3, DES PLAINES RIVER BASIN,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07577

**AN INVESTIGATION OF THE OCCURRENCE OF OCEANIC TURBULENCE WITH RESPECT TO FINESTRUCTURE,**  
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.  
For primary bibliographic entry see Field 2L.  
W76-07773

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07578

**THE SPECIFIC HEAT OF SALINE ICE,**  
McGill Univ., Montreal (Quebec). Ice Research Project.  
For primary bibliographic entry see Field 2C.  
W76-07776

**HEAVY METALS AS TRACE CONSTITUENTS IN NATURAL GROUNDWATERS AND POLLUTED,**  
Kiel Univ. (West Germany). Geologisch-Palaeontologisches Institut und Museum.  
For primary bibliographic entry see Field 5A.  
W76-07978

**ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, 1975--A BASIC-DATA REPORT,**  
Geological Survey, Albuquerque, N. Mex.  
For primary bibliographic entry see Field 4B.  
W76-07588

**APPLICATION OF THE STAINTON SYRINGE METHOD TO THE ANALYSIS OF MERCURY IN NATURAL WATERS,**  
Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.  
For primary bibliographic entry see Field 5A.  
W76-08025

**A NEW CONVENIENT METHOD FOR DETERMINING ARSENIC(+3) IN NATURAL WATERS,**  
Rutgers The State Univ., New Brunswick, N. J. Dept. of Environmental Sciences.  
For primary bibliographic entry see Field 5A.  
W76-08027

## WATER CYCLE—Field 2

### Estuaries—Group 2L

**GEOLOGY AND GROUND-WATER RESOURCES OF HETTINGER AND STARK COUNTIES, NORTH DAKOTA,**  
Geological Survey, Bismarck, N. Dak.  
For primary bibliographic entry see Field 4B.  
W76-08043

**QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PARTS 9 AND 10. COLORADO RIVER BASIN AND THE GREAT BASIN.**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W76-08045

**WATER RESOURCES DATA FOR COLORADO, 1974: PART 2. WATER QUALITY RECORDS,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 7C.  
W76-08047

**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--TEXAS-GULF REGION,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 2F.  
W76-08051

**SURFACE-WATER RESOURCES OF THE TAN-GIPAHOA, TCHEFUNCTA, AND NATALBANY RIVER BASINS, SOUTHEASTERN LOUISIANA,**  
Geological Survey, Baton Rouge, La.  
For primary bibliographic entry see Field 4A.  
W76-08056

**SOLUTE TRANSPORT AND MODELING OF WATER QUALITY IN A SMALL STREAM,**  
Geological Survey, Menlo Park, Calif.  
For primary bibliographic entry see Field 5B.  
W76-08058

**MIX2: A COMPUTER PROGRAM FOR MODELING CHEMICAL REACTIONS IN NATURAL WATERS,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W76-08062

### 2L. Estuaries

**PROCEEDINGS: SECOND WETLANDS CONFERENCE (HELD ON JANUARY 9, 1974 AT STORRS, CONNECTICUT),**  
Connecticut Univ., Storrs. Inst. of Water Resources.  
For primary bibliographic entry see Field 6E.  
W76-07451

**GRAYS HARBOR ESTUARY, WASHINGTON; REPORT 5, MAINTENANCE STUDIES OF 35-FT-DEEP (MSL) NAVIGATION CHANNEL; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07454

**TYPE 16 FLOOD INSURANCE STUDY: TSUNAMI PREDICTIONS FOR MONTEREY AND SAN FRANCISCO BAYS AND PUGET SOUND,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 6F.  
W76-07456

**SHORE EFFECT MODEL, ATLANTIC GENERATING STATION; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07457

**RIVER POINT DIRECTORY FOR THE MISSISSIPPI RIVER-GULF COAST INLAND WATERWAYS SYSTEM,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
L. L. Daggett, and R. W. McCarley.  
Available from the National Technical Information Service, Springfield, Va., 22161, as AD-A011 267, \$7.75 in paper copy, \$2.25 in microfiche. Miscellaneous Paper H-75-6, May 1975. 223 p, 1 tab, 4 append, 7 ref.

Descriptors: \*Gulf coastal plain, \*Inland waterways, \*Channels, Documentation, Publications.  
Identifiers: \*Gulf intercoastal waterway, \*Navigation directories, \*River point directory, Waterborne commerce.

The River Point Directory is a quick-reference working document for use by engineers and planners in the general fields of river navigation and waterborne commodity movements. All navigable rivers, bayous, streams, and other such waterways in the Mississippi River-Gulf Coast region are included. The rivers are, in general, listed in the order of their importance as commodity transportation arteries with regard to varying degrees of impact on the economic welfare of the United States. The Directory is, in essence, a compilation of significant data relating to each commercial dock, town, landing, navigation lock, bridge, junction, and other such river points contained in selected portions of the U. S. Army Engineer Waterborne Commerce Statistical Center (WSCS) Port and Dock Code Manual (Parts 2 and 3), dated 1 January 1973. (WES)  
W76-07458

**CHESAPEAKE BAY RADIOACTIVE TRACER STUDY,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 5B.  
W76-07460

**WESTPORT SMALL-BOAT BASIN REVISION STUDY; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07462

**PHYSICAL HYDRAULIC MODELS: ASSESSMENT OF PREDICTIVE CAPABILITIES; REPORT 1, HYDRODYNAMICS OF THE DELAWARE RIVER ESTUARY MODEL,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07463

**EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE ALEUTIAN TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07464

**MASONBORO INLET, NORTH CAROLINA, MOBILE-BED HYDRAULIC MODEL STUDY,**

**EFFECTS OF TEMPERATURE AND EXPERIMENTAL PROCEDURES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07466

**MOBILE BAY MODEL STUDY: EFFECTS OF PROPOSED THEODORE SHIP CHANNEL AND DISPOSAL AREAS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07467

**EXPANSION OF PORT HUENEME, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07468

**LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY: REPORT 5, TIDAL VERIFICATION AND BASE CIRCULATION TESTS,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07474

**DESIGN OF JUBAIL HARBOR, SAUDI ARABIA, ROYAL SAUDI NAVAL EXPANSION PROGRAM; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07475

**DESIGN OF AGANA SMALL-BOAT HARBOR, TERRITORY OF GUAM; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07478

**ABUNDANCE, DIVERSITY AND SEASONALITY OF FISHES IN COLORADO LAGOON, ALAMITOS BAY, CALIFORNIA,**  
California State Univ., Fullerton. Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W76-07482

**A STUDY OF THE FAUNA IN DREDGED CANALS OF COASTAL LOUISIANA,**  
Louisiana Wildlife and Fisheries Commission, New Orleans.  
For primary bibliographic entry see Field 5C.  
W76-07486

**FORM, GENESIS, AND DEFORMATION OF CENTRAL CALIFORNIA WAVE-CUT PLATFORMS,**  
Colorado Univ., Boulder. Dept. of Geological Sciences.  
W. C. Bradley, and G. B. Griggs.  
Geological Society of America Bulletin, Vol. 87, No. 3, p 433-449, March 1976. 16 fig, 5 tab, 123 ref. NSF G19774

Descriptors: \*Geomorphology, \*Shoreline cover, \*California, Shores, Sea level, Deformation, Folds(Geologic), Bedrock, Sediment transport, Erosion, Waves(Water), Currents(Water), Quaternary period.  
Identifiers: \*Shore features, \*Ben Lomond Mountain(Calif), Marine terraces, Sea level changes,

## Field 2—WATER CYCLE

### Group 2L—Estuaries

Uplift rates, Platforms, Platform ages, Terrace deposits, Nearshore process, Wave drift.

Modern and ancient wave-cut platforms on Ben Lomond Mountain in central California are broadly similar in shape. They have a seaward slope composed of two segments: a steeper, slightly concave inshore segment, with gradients of generally 0.02 to 0.04, and a flatter, planar offshore segment with gradients of 0.007 to 0.017. The flattest inshore and offshore gradients measured were, respectively, 0.015 and 0.005, suggesting that these are close to minimum gradients for erosional platforms in central California. The inshore segments are generally 300 to 600 m wide and extend to a depth of 8 to 13 m. Platforms are widest in areas where soft sandstone crops out and where there has been least uplift. Major storm waves now break in water 7 to 12 m deep. It was concluded that inshore platform segments were associated with storm-wave surf zones and that offshore segments were associated with the zone of deep-water wave transformation. Ben Lomond platforms have been uplifted and progressively tilted in a seaward direction, indicating that late Tertiary domical uplift has continued into Quaternary time. Uplift rates have ranged from 0.16 m/1000 yr near Santa Cruz to 0.26 m/1000 yr near Greyhound Rock. (Lee - ISWS)  
W76-07552

**SOME OBSERVATIONS OF THE DEEP FLOW IN THE BORNHOLM STRAIT DURING THE PERIOD JUNE 1973-DECEMBER 1974,**  
Goteborg Univ. (Sweden). Oceanographic Inst.  
O. Petren, and G. Walin.  
Tellus, Vol. 28, No. 1, p 74-87, 1976. 15 fig, 1 tab, 4 ref.

Descriptors: \*Salinity, \*Flow, \*Straits, On-site investigations, On-site data collections, Measurement, Saline water, Channels, Surface waters, Hydrography, Oceanography.  
Identifiers: \*Bornholm Strait, \*Baltic Sea, \*Sweden.

Preliminary observations of the deep water flow penetrating into the Baltic were presented. An important feature of the measurements is that the distribution of the flux with respect to salinity were resolved. The mean salt and volume fluxes obtained from the observations were checked against the fresh water supply with surprisingly good result. (Sims - ISWS)  
W76-07557

**ANCHOR-LAST DEPLOYMENT SIMULATION BY LUMPED MASSES,**  
Oregon State Univ., Corvallis. Dept. of Mechanical and Nuclear Engineering.

R. W. Thresher, and J. H. Nath.

Journal of the Waterways, Harbors and Coastal Engineering Division, American Society of Civil Engineers, Vol. 101, No. WW4, Proceedings Paper 11709, p 419-433, November 1975. 14 fig, 2 tab, 9 ref, 3 append. ONR N00014-67-A-0369-007.

Descriptors: \*Anchors, \*Buoys, \*Research equipment, Model studies, Mathematical models, Numerical analysis, Simulation analysis, Loads(Forces), Peak loads, Stress, Velocity, Mechanical properties, Equipment, Analytical techniques, Mechanical engineering, Oceanography.

Identifiers: Lumped-mass solutions, Dynamic response, Cables, Moorings.

Often the anchor is deployed as the final action in the mooring of buoys in the water. It has not been economical to calculate the transient conditions in the mooring line until a predictor-corrector technique was developed, which calculates the positions of the anchor and mooring line, the accompanying velocities, and the tensions throughout the line, all as a function of time. This study was based on a numerical lumped mass

model representation of a single continuous nylon line 5000 ft long. The results obtained showed no line snap loads for the configurations considered. It appears that the high drag of the long mooring line quickly dissipates the kinetic energy of the anchor and reduces the anchor velocity to about 10 fps-15 fps. The buoy horizontal velocity of 10 fps would tend to indicate the potential for large dynamic loads from wave motion. (Sims - ISWS)  
W76-07559

**A WIND-DRIVEN NEAR-BOTTOM CURRENT IN THE SOUTHERN NORTH SEA,**  
British Petroleum Co. Ltd., Sunbury-on-Thames (England). Research Centre.

V. N. D. Caston.  
Estuarine and Coastal Marine Science, Vol. 4, No. 1, p 23-32, January 1976. 5 fig, 22 ref.

Descriptors: \*Currents(Water), \*Ocean currents, \*Winds, Sediment transport, Tides, Offshore platforms, Oil wells, On-site investigations, Wind tides, Wind velocity, Oceanography.

Identifiers: \*North Sea.

Simultaneous recordings of wind and near-bottom current velocity and direction were made over the period November 8-December 16, 1976 from two production platforms situated in the southwestern North Sea. The current measurements were made 4.6 m above sea bed in a total water depth of 34.7 m LAT. Throughout the greater part of the period the recorded current velocities agreed closely with predicted values calculated on the basis of a correlation with tidal range data. Over a 125-hr period, however, the south-going currents were very much stronger and the north-going streams considerably less than anticipated. This corresponded with a period of high wind speeds which touched 25.7 m/s (50 kts) and exceeded 18 m/s (35 kts) for 68 hr and which blew sub-parallel to the direction of flow of the southerly-flowing current. The increase in velocity of the near-bottom southerly-going current averaged 23 cm/s, exceptionally 36 cm/s, and was equivalent to a figure of between 1.4 and 2% of the wind speed. It was suggested that these anomalously high values may be related to a shift in the axes of current streams flowing between sand banks adjacent to the platform from which the current measurements were made. (Sims-ISWS)  
W76-07562

**NUMERICAL CALCULATION OF THE WAVE INTEGRALS IN THE LINEARIZED THEORY OF WATER WAVES,**

Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 8B.  
W76-07565

**ESTABLISHMENT OF VEGETATION FOR SHORELINE STABILIZATION IN GALVESTON BAY,**

Texas A and M Univ., College Park, Dept. of Range Science.  
J. D. Dodd, and J. W. Webb.  
Available from the National Technical Information Service, Springfield, Va., 22161, as AD-A012 839, \$4.50 in paper copy, \$2.25 in microfiche. Coastal Engineering Research Center Miscellaneous Paper No. 6-75, April 1975. 67 p, 13 fig, 27 tab, 20 ref. CERC DACW72-74-C-0002

Descriptors: \*Shore protection, \*Vegetation, \*Erosion, \*Texas, Vegetation establishment, Marsh plants, Coastal marshes, Shoreline cover, Salinity, Salt tolerance, Saline soils, Bays, Estuaries.

Identifiers: \*Galveston Bay(Tex), \*Upper Texas Coast, Wave stilling.

The objective of this study was to determine which resident species of plants adapted to saline conditions can be used to control shore erosion in

bays or estuaries. Water salinity and soil physical and chemical characteristics were determined at the experimental planting sites at East Bay near Galveston, Texas. The soil was loam or clay-loam texture and was structurally unstable and subject to wave erosion. Soil salinity varied from 2500 to more than 12,000 parts per million and water salinity from below 2500 to 18,000 parts per million. Twelve plant species were selected for evaluation of their ability to stabilize the shoreline. Giant reed (*Arundo donax*) is effective in the upper zone (above MHW). Black mangrove (*Avicennia germinans*) can establish in the middle zone (MLW to MHW) and lower zone (below MLW). Saltgrass (*Distichlis spicata*) may be used in the middle zone if wave action is low at planting time. Gulf cordgrass (*Spartina spartinae*) is adapted for use in the upper zone and smooth cordgrass (*Spartina alterniflora*) is well adapted for use in the middle and lower zones. Several combinations of species were suggested for different zones. An inexpensive wave-stilling device to protect planting from wave action was described. (Sims-ISWS)  
W76-07567

**HYDROLOGIC CHARACTERISTICS OF LAGOONS AT SAN JUAN, PUERTO RICO, DURING A JANUARY 1974 TIDAL CYCLE,**  
Geological Survey, Fort Buchanan, Puerto Rico.

For primary bibliographic entry see Field 5B.

W76-07597

**WATER-RESOURCES RECONNAISSANCE OF ST. GEORGE ISLAND, PRIBILOF ISLANDS, ALASKA,**

Geological Survey, Anchorage, Alaska.

For primary bibliographic entry see Field 4A.

W76-07601

**TAXONOMIC DIFFICULTIES IN RED TIDE AND PARALYTIC SHELLFISH POISON STUDIES: THE 'TAMARENSIS COMPLEX' OF CONYALUX,**

British Columbia Univ., Vancouver. Inst. of Oceanography.

For primary bibliographic entry see Field 5C.

W76-07614

**THE 1971 RED TIDE AND ITS IMPACT ON CERTAIN REEF COMMUNITIES IN THE MID-EASTERN GULF OF MEXICO,**

Florida Dept. of Natural Resources, St. Petersburg, Marine Research Lab.

For primary bibliographic entry see Field 5C.

W76-07615

**LAND DRAINAGE AS A FACTOR IN 'RED TIDE' DEVELOPMENT,**

Department of the Environment, Ottawa (Ontario). Shellfish Water Quality Div.

For primary bibliographic entry see Field 5C.

W76-07616

**SOME OF THE GROWTH CHARACTERISTICS OF GONYAULAX TAMARENSIS ISOLATED FROM THE GULF OF MAINE,**

Salem State College, Mass. Dept. of Biology.

For primary bibliographic entry see Field 5C.

W76-07617

**REPORT ON A BIOCHEMICAL RED TIDE REPRESSIVE AGENT,**

University of South Florida, Tampa. Dept. of Chemistry.

For primary bibliographic entry see Field 5C.

W76-07618

## WATER CYCLE—Field 2

### Estuaries—Group 2L

**IMPLICATIONS OF DINOFLAGELLATE LIFE CYCLES ON INITIATION OF GYMNODINIUM BREVE RED TIDES,**  
Florida Dept. of Natural Resources, St. Petersburg, Marine Research Lab.  
For primary bibliographic entry see Field 5C.  
W76-07619

**AN ANALYTICAL STUDY OF THE ROLE OF VARIOUS FACTORS CAUSING RED TIDE OUTBREAKS OF TRICHODISMUM AS DEDUCED FROM FIELD AND LABORATORY OBSERVATION,**  
For primary bibliographic entry see Field 5C.  
W76-07620

**OCCURRENCE OF FORAMINIFERA, MOLLUSCS AND OSTRACODS ADJACENT TO THE INDUSTRIALIZED SHORELINE OF CANSO STRAIT, NOVA SCOTIA,**  
Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).  
For primary bibliographic entry see Field 5C.  
W76-07621

**WATER RESOURCES ISSUES AND THE 1972 UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT,**  
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W76-07688

**AN ENZOOTIC NUCLEAR POLYHEDROSIS VIRUS OF PINK SHRIMP: ULTRASTRUCTURE, PREVALENCE, AND ENHANCEMENT,**  
Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.  
For primary bibliographic entry see Field 5C.  
W76-07695

**AN INVESTIGATION OF THE OCCURRENCE OF OCEANIC TURBULENCE WITH RESPECT TO FINESTRUCTURE,**  
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.  
A. E. Gargett.  
Journal of Physical Oceanography, Vol. 6, No. 2, p 139-156, March 1976. 9 fig, 2 tab, 24 ref.

Descriptors: \*Oceans, \*Turbulence, \*Temperature, \*Salinity, \*Pacific Ocean, \*Mixing, Density, Surveys, Measurement, Instrumentation, Circulation, Ocean circulation, On-site data collections, Oceanography, Profiles, Stratification.

Identifiers: \*Finestructure.

Data obtained from the cycling mode of a towed system operated in the North Pacific were used to investigate the relationship of small-scale mixing to the finestructure which seems to be such a common characteristic of vertical profiles of oceanic water properties. The signal from a high-frequency response platinum-film thermometer was used, with the local mean vertical temperature gradient, to produce variables proportional to heat flux and eddy diffusivity for heat. Along with measured values for the local vertical salinity and density gradients, this information was used to examine some questions of interest in the general understanding of turbulence and finestructure. It was shown that in regions where the vertical density structure is distinctly layered, there is no noticeable tendency for mixing to occur preferentially on 'sheets,' the high-density-gradient regions which separate 'layers' of lower density gradient. Mixing events seem to occur at random with respect to the density field, suggesting that such events do not arise predominantly as small-scale Kelvin-Helmholtz instabilities on pre-existing finestructure. Instead, the evidence points to a much closer connection between turbulent mixing and the

processes which act to produce and destroy finestructure. Between 60 and 70% of the turbulence encountered in the tows was associated with 'active' regions, areas where the vertical profiles of temperature and/or salinity show finestructure inversions. The density profile in such regions is often 'steppy' but invariably statically stable on vertical scales greater than about a meter, so that some basically horizontal process, such as inertial waves or density-driven interleaving, is required to produce the inversions in temperature and salinity. (Sims - ISWS)  
W76-07773

**A THREE-DIMENSIONAL SIMULATION OF COASTAL UPWELLING OFF OREGON,**  
Florida State Univ., Tallahassee Dept. of Oceanography.

M. B. Peffley, and J. J. O'Brien.  
Journal of Physical Oceanography, Vol. 6, No. 2, p 164-180, March 1976. 13 fig, 1 tab, 31 ref, 1 append. NSF GX-33502.

Descriptors: \*Upwelling, \*Coasts, \*Oregon, \*Pacific Ocean, \*Model studies, Mathematical models, Topography, Ocean circulation, Oceans, Oceanography, \*Simulation analysis.  
Identifiers: \*Cape Blanco(Ore).

The wind driven, x-y-t, two-layer beta-plane numerical model developed by Hurlbut was used to investigate the effects of a bottom topography and coastline configuration, like that off Oregon, on the onset and decay of the ocean upwelling circulation. The digitized nearshore Oregon bathymetry was analyzed for dominant scales, and a smoothed version was used in model cases with several different initial states and wind stresses. Cases with topography were compared to cases with plane sea beds. Topographic variations were found to dominate over coastline irregularities in determining the longshore distribution of upwelling. Results indicated that stronger upwelling observed near Cape Blanco is primarily due to the local bottom topography and not the cape itself. Observed variations in the meridional and zonal flow were attributed to the topographic beta-effect. In particular, during spin-up with an equator-ward wind stress, a nearshore poleward undercurrent is most likely to develop in regions where topographic beta is positive. Upper layer poleward flow was observed during spin-down. The existence of an onshore transport jet south of Cape Blanco was predicted. Zonal mass balance was not observed. Topographic Rossby waves were excited during spin-up. Baroclinic continental shelf waves were observed in time series of the pycnocline height contours. (Sims-ISWS)  
W76-07775

**THE SPECIFIC HEAT OF SALINE ICE,**  
McGill Univ., Montreal (Quebec). Ice Research Project.  
For primary bibliographic entry see Field 2C.  
W76-07776

**A BOUNDARY FRONT IN THE SUMMER REGIME OF THE CELTIC SEA,**  
University Coll. of North Wales, Menai Bridge. Marine Science Labs.

J. H. Simpson.  
Estuarine and Coastal Marine Sciences, Vol. 4, No. 1, p 71-81, January 1976. 6 fig, 9 ref.

Descriptors: \*Temperature, \*Salinity, \*Saline water-freshwater interfaces, \*Ocean circulation, Buoys, Floats, Measurement, On-site investigations, On-site data collections, Water circulation, Density currents, Oceans, Estuaries, Oceanography.  
Identifiers: \*Celtic Sea.

Sections through a region of low tidal stream energy in the Celtic Sea in August show a high degree of stratification, which breaks down abruptly at

the entrance to the Irish Sea and the Bristol Channel. Radio tracked parachute drogues have been used to observe the flow both along the front and at the center of the low energy region. A temperature-salinity-density section of the front, combined with the drogue observations, indicated that the front contains a strongly baroclinic zone implying velocity components parallel to the front of up to 30 cm/s. The residual velocities observed in the low energy region were found to be in approximate geostrophic balance with the density field and in a westerly direction, with a maximum amplitude of about 9 cm/s. (Sims - ISWS)  
W76-07782

**SEASONAL REVERSAL OF FLOOD-TIDE DOMINANT SEDIMENT TRANSPORT IN A SMALL OREGON ESTUARY,**

Oregon Univ., Eugene. Dept. of Geology.  
S. Boggs, Jr., and C. A. Jones.  
Geological Society of America Bulletin, Vol. 87, No. 3, p 419-426, March 1976. 13 fig, 3 tab, 24 ref.

Descriptors: \*Sedimentation, \*Sediment transport, \*Oregon, Fluorescent dye, Estuaries, Tides, Tidal streams, Hydrology, Currents(Water), Dye releases, Discharge(Water), Sedimentary structures.

Identifiers: \*Bed forms, \*Sixes River(Ore), Heavy minerals, Tidal currents, Coastal streams.

The Sixes River in southwestern Oregon has a summer discharge of only about 2 cu m/sec. During these low-discharge conditions, a flood-dominated system of bottom tidal currents develops in the estuary and a delta-like sill, as much as 1.5 m in height, builds across the mouth of the estuary by upstream progradation. Flood-tide currents move across this sill at velocities of as much as 90 cm/sec 15 cm above the bottom, but the velocity of ebb-tide currents usually does not exceed about 40 cm/sec. Dispersal patterns of dyed sediment injected at the river mouth during low river discharge showed that flood-tide currents transport sand across the sill and up the estuary as far as 0.8 km (about one-fourth the length of the estuary) in a single flood-tide phase. During ebb tide, the sill impedes movement of salt water along the estuary bottom, producing a sharply stratified two-layer water system. River discharge after winter storms may increase to more than 400 cu m/sec, and large quantities of detritus, including gravel, are transported downstream into and through the estuary. High river discharge also causes erosion of the sill, greatly reducing the sediment-trapping capacity of the estuary. The finer fluvial detritus, together with fine marine sediment deposited during the summer, is swept from the estuary, leaving it flooded largely by gravel. (Lee - ISWS)  
W76-07783

**COASTAL EROSION HAZARD IN THE UNITED STATES: A RESEARCH ASSESSMENT,**  
Rutgers - The State Univ., New Brunswick, N.J. J. H. Sorensen, and J. K. Mitchell.

Available from the National Technical Information Service, Springfield, Va., 22161 as PB-2442 974, \$5.00 paper copy, \$2.25 in microfiche. Colorado University Institute of Behavioral Science Monograph NSF-RA-E-75-014, 1975. 65 p, 4 fig, 10 tab, 91 ref. NSF GI-32942.

Descriptors: \*Coasts, \*Erosion, \*Hazards, \*Research priorities, Coastal structures, Shore protection, Land use, Warning systems, Forecasting, Rehabilitation, Beach erosion, Coastal engineering, Ocean waves, Storms.

Research on coastal erosion has traditionally been centered on control and protection works designed to eliminate erosion causes or to reduce direct damages. Since 1970, Federal initiatives have prompted the development of new adjustment options which hold the promise of diversifying attempts to cope with the hazard. This has set the

## Field 2—WATER CYCLE

### Group 2L—Estuaries

stage for research which would enable the nation to make more effective use of new developments in coastal erosion management. Approximately one quarter of the national shoreline is significantly affected by erosion. Critical erosion occurs along 2700 miles of coastline, chiefly on the heavily populated Atlantic and Great Lake coasts. Problems are caused when erosional processes and human activities conflict. Average shoreline recessions of less than one foot per year on densely settled coasts may produce heavy damages, while elsewhere, in sparsely populated coastal areas, annual recessions of more than 20 feet may pose no significant hazard. Both erosion and accumulation are influenced by man-induced, as well as natural processes. Research on coastal erosion is indicated along four major lines: (1) control and protection works, (2) land use management, (3) warnings and forecasting, and (4) relief, rehabilitation, and insurance. The emphasis reflects shifts in management policies in the past few years which may allow significant reductions in erosion damages if the necessary technology and knowledge becomes available. (Sims - ISWS)

W76-07788

**MODELS FOR IMPLEMENTING THE CZMA'S CONCEPT OF STATE-LOCAL RELATIONS,**  
Nassau-Suffolk Regional Planning Board, N. Y.  
For primary bibliographic entry see Field 6E.

W76-07803

**COASTAL BOUNDARY LITIGATION WITH THE STATE: A FRAME OF REFERENCE,**  
Florida State Dept. of Environmental Regulation, Tallahassee.  
For primary bibliographic entry see Field 6E.

W76-07804

**THE HAWAIIAN ARCHIPELAGO DEFINING THE BOUNDARIES OF THE STATE,**  
Hawaii Univ., Honolulu. School of Law.  
For primary bibliographic entry see Field 6E.

W76-07818

**PUBLIC RIGHTS IN GEORGIA'S TIDELANDS,**  
Georgia Univ., Athens. Inst. of Government.  
For primary bibliographic entry see Field 6E.

W76-07824

**GEOGRAPHY AND THE LOS DEBATE: GEOGRAPHICAL FACTORS AND THE PATTERNS OF ALIGNMENT,**  
Rhode Island Univ., Kingston. Law of the Sea Inst.  
For primary bibliographic entry see Field 6E.

W76-07826

**MAJOR ISSUES OF THE LAW OF THE SEA,**  
New Hampshire Univ., Durham.  
For primary bibliographic entry see Field 6E.

W76-07827

**INTRODUCTION,**  
New Hampshire Univ., Durham. Dept. of Political Science.  
For primary bibliographic entry see Field 6E.

W76-07828

**CONCLUSION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
For primary bibliographic entry see Field 6E.

W76-07842

**TWO-HUNDRED-MILE FISHING ZONE.**  
For primary bibliographic entry see Field 6E.

W76-07863

**PRODUCTION OF SOME MASS CRUSTACEANS OF THE KUIBYSHEV RESERVOIR IN THE REGION OF SVIYAZH BAY, (IN RUSSIAN),**  
Kazan State Univ. (USSR). Dept. of Vertebrate Zoology.

For primary bibliographic entry see Field 5C.  
W76-07935

surface area of 36.5 km<sup>2</sup> and a volume of 0.541 km<sup>3</sup>, was calculated at 5.3 x 10<sup>3</sup> metric tons, and for the Mar Piccolo, with a surface area of 20.7 km<sup>2</sup> and a volume of 0.152 km<sup>3</sup>, at 2.8 x 10<sup>3</sup> metric tons.

W76-07947

**STUDY OF OCEANOGRAPHIC CONDITIONS IN THE AROSA ESTUARY IN WATER, (IN SPANISH),**  
J. G. Gallego.  
Bol Inst Esp Oceanogr 185, p 1-53, 1975.

Descriptors: Estuaries, Oceanography, Salinity, Water temperature, Oxygen, Data collections, Winter, Dissolved oxygen.

Identifiers: \*Spain(Arosa estuary).

Data were obtained from 25 stations distributed over the entire estuary from Jan. 20th-Feb. 26th 1969. The variations in temperature and salinity in relation to the space, depth, time and state of the tide were studied together with the intensity and direction of the currents, according to depth and tide. The stability of the water and, on a more superficial level, the dissolved O<sub>2</sub> were also studied. The in situ meteorological conditions were constantly accounted for. Copyright 1975, Biological Abstracts, Inc.

W76-07948

**APPLICATIONS OF SHANNON'S INDEX TO THE STUDY OF INTERTIDAL VEGETATION, (IN FRENCH),**  
Instituto de Investigaciones Pesqueras, Vigo (Spain). Laboratorio de Investigaciones Pesqueras.

J. Niell.

Bull Soc Phycol Fr 19, p 238-254, 1974.

Descriptors: \*Productivity, Vegetation, Succession, Maturity, Intertidal areas.

Identifiers: \*Shannons Index.

The Shannon index has been used to study benthic community structure. Using this index to measure diversity, a minimum work area is determined. Different types of vegetation become evident when the limits of the spacial distribution are studied. These types are related to ecological accidents. Diversity values are used to know the community structure, its importance in succession and its maturity. Diversity indexes are related to productivity and biomass intuitively. Copyright 1975, Biological Abstracts, Inc.

W76-07949

**MINIMAL AREA AND ALGAL MARINE SETTLEMENTS, (IN FRENCH),**  
Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Végétale.  
C. F. Boudouresque.  
Bull Soc Phycol Fr 19, p 141-157, 1974.

Descriptors: Productivity, Lakes, Gulf, Saline water, Climates, Mussels, Plankton, Water temperature.

Identifiers: \*Italy, Mar-Grande, Mar-Piccolo, Springs, Taranto.

The Mar Grande of Taranto (Italy) communicates almost freely with the Gulf of the same name; the Mar Piccolo, divided by a bottleneck into 2 basins, is more like a salty coastal lake. From its bottom emerge numerous underwater springs, known as citri, which act as thermosaline regulators, to the advantage of the cultivation of mussels. For 8 yr, in 4 fixed stations, monthly hydrographic measurements were taken, combined with vertical catches of plankton and measurements of productivity with <sup>14</sup>C. The environment is affected by the climatic conditions of the region with its heavy winter rains and prolonged summer droughts. The net annual productivity for the Mar Grande, with a

W76-07951

**PRELIMINARY NOTE ON THE ALGAL POPULATION OF THE SCIOPHILOUS SURFACE BIOTOPES IN THE EXPOSED MODE, OF THE**

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Use Of Water Of Impaired Quality—Group 3C

**ISLAND OF LINOSA (STRAIT OF SICILY, ITALY), (IN FRENCH),**  
Naples Zoological Station (Italy).  
F. Cinelli, G. Furnari, G. Giaccone, B. Scammacca, and A. Solazzi.  
Bull. Soc. Phycol. Fr. 19, p 95-100, 1974.

Descriptors: Algae, Marine algae, Vegetation, Europe, Aquatic habitats.

For the 1st time the algal vegetation, of Linosa, an islet between Malta and Tunisia, was studied in toto (with physico-chemical records). The sciaophilic population of algae in an exposed habitat was studied with the help of a sociological and statistical method.—Copyright 1975, Biological Abstracts, Inc.

W76-07952

**THE PRIMARY PRODUCTIVITY OF MARINE MACROPHYTES FROM A ROCKY INTERTIDAL COMMUNITY,**  
California Univ., Irvine. Dept. of Population and Environmental Biology.  
For primary bibliographic entry see Field 5C.

W76-07965

**AMERICAN LOBSTERS AT ARTIFICIAL REEFS IN NEW YORK,**  
New York Dept. of Environmental Conservation, Delmar. Wildlife Research Lab.  
P. T. Briggs, and C. S. Zawacki.  
N Y Fish Game J. 21(1), p 73-77, 1974.

Descriptors: \*Lobsters, Atlantic Ocean, Bays, Population, \*Reefs, \*New York.  
Identifiers: \*Artificial reefs, Great South Bay(NY).

The American lobster (*H. americanus*) was studied at 2 artificial reefs, one in Great South Bay (New York) and the other in the Atlantic Ocean. Different catch rates, sizes and sex ratios were observed at these reefs. The differences in population parameters appeared to be primarily a result of onshore migration of adult lobsters from offshore stocks to the oceanic reef. Higher catch rates at the oceanic reef were attributed to both longer fishing time for the gear there and the onshore migration of lobsters from offshore stocks.—Copyright 1974, Biological Abstracts, Inc.

W76-07967

**PHYTOPLANKTON OF THE TAMPA BAY SYSTEM, FLORIDA,**  
Texas A and M Univ., College Station. Dept. of Oceanography.  
For primary bibliographic entry see Field 5C.

W76-07973

**MEASUREMENTS OF PHYTOL IN ESTUARINE SUSPENDED ORGANIC MATTER,**  
Naval Research Lab., Washington, D.C.  
For primary bibliographic entry see Field 5A.

W76-07974

**THE GRADIENT OF SALINITY, ITS SEASONAL MOVEMENT, AND ECOLOGICAL IMPLICATIONS FOR THE LAKE IZABAL-RIO DULCE ECOSYSTEM, GUATEMALA,**  
Florida Univ., Gainesville. Dept. of Botany.  
For primary bibliographic entry see Field 5C.

W76-07975

**EFFECT OF A SUBLETHAL CONCENTRATION OF PHENOL ON SOME BLOOD PLASMA ENZYME ACTIVITIES IN THE PIKE (ESOX LUCIUS L.) IN BRACKISH WATER,**  
Helsinki Univ. (Finland). Dept. of Zoology.  
For primary bibliographic entry see Field 5C.

W76-07977

**MERCURY IN SOME MARINE ORGANISMS FROM THE OSLOFJORD,**  
Oslo Univ. (Norway). Dept. of Marine Zoology.  
For primary bibliographic entry see Field 5C.

W76-07982

**STUDIES OF PARAGONIMUS OHIRAI MIYAZAKI: 1939 AND P. SADOENSIS MIYAZAKI ET AL. 1968 FOUND IN NOTO PENINSULA, ISHIKAWA PREFECTURE: JAPAN, (IN JAPANESE),**  
Kyushu Univ., Fukuoka (Japan). Lab. of Medical Zoology; and Kyushu Univ., Fukuoka (Japan). School of Health Science.  
For primary bibliographic entry see Field 5C.

W76-07991

**PRELIMINARY NOTE ON THE OBSERVATION OF TERRIGENOUS DRIFTS INTO THE SEA, OBTAINED BY MEANS OF TELEVISED PICTURES TRANSMITTED BY ARTIFICIAL SATELLITES, (IN FRENCH),**  
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.  
For primary bibliographic entry see Field 5B.

W76-07992

**THE GULF AND THE ESTUARY OF THE SAINT-LAWRENCE RIVER: REVIEW OF THE PRINCIPAL PAPERS ON CHEMICAL OCEANOGRAPHY, (IN FRENCH),**  
Quebec Univ., Rimouski (Quebec). Dept. of Pure Sciences.

For primary bibliographic entry see Field 5B.  
W76-07993

**NEKTON POPULATION DYNAMICS IN THE ALBEMARLE SOUND AND NEUSE RIVER ESTUARIES,**  
North Carolina Univ., Raleigh. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.

W76-08037

**A STUDY OF THE MARINE RESOURCES OF HINGHAM BAY,**  
For primary bibliographic entry see Field 5C.  
W76-08039

**A SURVEY OF ENVIRONMENTAL FEATURES IN A SECTION OF THE VELLAR-COLERON ESTUARINE SYSTEM, SOUTH INDIA,**  
Centre of Advanced Study in Marine Biology, Porto Novo (India).  
For primary bibliographic entry see Field 5C.

W76-08040

**EXTENSION OF THE TORSHAVN BREAK-WATERS,**  
E. Pihl & Son AS, Copenhagen, Denmark.  
For primary bibliographic entry see Field 8A.

W76-08071

**AN EXPLORATORY SURVEY AND ANALYSIS OF SAILING IN GALVESTON BAY, TEXAS,**  
Texas A and M Univ., College Station. Coll. of Agriculture.  
For primary bibliographic entry see Field 6B.

W76-08095

### 3. WATER SUPPLY AUGMENTATION AND CONSERVATION

#### 3A. Saline Water Conversion

**MERCURY RECOVERY,**  
For primary bibliographic entry see Field 5D.  
W76-07627

**APPLICATION OF SYSTEM ANALYSIS IN TWO-STAGE REVERSE OSMOSIS PROCESS DESIGN FOR WATER DESALINATION,**  
National Research Council of Canada, Ottawa, Division of Chemistry.

H. Ohya, S. Kasahara, and S. Sourirajan.  
Desalination, Vol. 16, No. 3, p 375-393, June 1975.  
9 fig, 1 tab, 8 ref.

Descriptors: \*Reverse osmosis, \*Desalination, \*Systems analysis, \*Water treatment, \*Water quality, Design, Water supply, Operations, Pressure, Flow rates, Computers, \*Waste water treatment.

The concepts of system specification and systems analysis concerning reverse osmosis transport have been extensively developed and discussed in the literature; the application of these concepts to single-stage reverse osmosis process design for water desalination has been reported. This paper illustrates a similar application of the above concepts for a two-stage desalination process. The basic equations used have already been derived and are readily available in the literature. The problem is concerned with reverse osmosis desalination of an aqueous sodium chloride solution using Loeb-Sourirajan type cellulose acetate membranes to yield potable water. Further, the problem is to calculate the minimum power requirements for producing 1000 gallons of potable water, and the total membrane area requirements for a million gallons of potable water per day plant on the basis of specified operating requirements. The systems analysis approach illustrated herein offers a useful method for both two-stage and single-stage process design and optimization for reverse osmosis desalination. (Bell-Cornell)  
W76-08076

### 3B. Water Yield Improvement

**SURVEY OF IRRIGATION CANAL ECOLOGICAL PARAMETERS INFLUENCING AQUATIC WEED GROWTH,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 4A.  
W76-07609

**WEATHER MODIFICATION IN THE LAKE TAHOE BASIN,**  
H. E. Klieforth.  
In Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sands Vagabond Convention Center, South Lake Tahoe, California. Report No. NSF/RA/G-74-012, p 69-77.

Descriptors: \*Weather modification, \*Cloud seeding, \*California, \*Nevada, Artificial precipitation, Precipitation(Atmospheric), Rain, Snow, Silver iodide, Meteorology.

Identifiers: \*Lake Tahoe(Nev-Calif).

The history of weather modification by cloud seeding was reviewed. Some cloud seeding projects in the vicinity of Lake Tahoe were discussed. (See also W76-07793) (Sims - ISWS)  
W76-07798

**GEOHYDROLOGIC RECONNAISSANCE OF THE IMPERIAL VALLEY, CALIFORNIA,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 4B.  
W76-08052

### 3C. Use Of Water Of Impaired Quality

**PERSPECTIVE ON USE OF FRESH WATER FOR COOLING SYSTEMS OF THERMOELECTRIC POWERPLANTS IN FLORIDA,**  
Geological Survey, Tallahassee, Fla.

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3C—Use Of Water Of Impaired Quality

For primary bibliographic entry see Field 3E.  
W76-07596

**PRELIMINARY OBSERVATION ON SEASONAL CHANGES IN THE SALT CONTENT OF AN IRRIGATED SOIL UNDER WHEAT-MAIZE ROTATION,**  
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soils.  
Arjan Singh, and N. T. Singh.  
J Indian Soc Soil Sci. 22(2), p 156-161, 1974.

Descriptors: \*Seasonal, \*Corn(Field), \*Wheat, \*Rotations, \*Saline soils, Irrigation, Water table, Soil profiles, Soil moisture.

Seasonal changes in the salt content of an irrigated sandy soil under maize-wheat rotation were recorded. Water table depth in the area fluctuated and was within 150 cm from the surface during the monsoon season. Salt accumulation at and near the soil surface was at maximum during the hotter days of summer but returned to the previous level after the end of monsoon season. Salt balance of the profile did not change appreciably during the 2-yr period. Monsoon rains appear to be very effective in checking salt build-up in the surface soil.-- Copyright 1975, Biological Abstracts, Inc.  
W76-07954

**THE PHYSICO-CHEMICAL CHANGES OF NEWLY FLOODED SOILS,**  
Andhra Pradesh Univ., Hyderabad (India). Agricultural Research Inst.  
For primary bibliographic entry see Field 2G.  
W76-07980

**EFFECT OF WATER AND NUTRIENT REGIMES OF PEAT SOIL ON THE QUALITATIVE COMPOSITION OF STARCH IN POTATO TUBERS, (IN RUSSIAN),**  
Akademii Nauk URSR, Kiev. Institut Fiziologii Rastenii i Agrokhimi. I. A. Grigoryuk, N. N. Shevchenko, and S. I. Slukhai. Fiziol Biokhim Kul't Rast 7(2), p 145-151, 1975.

Descriptors: \*Potatoes, Crop production, Fertilizers, Nutrients, \*Phosphorus, Peat, \*Copper.  
Identifiers: \*Starch, \*Potato tubers.

The effect of potassic-P and Cu fertilizers and different levels of ground waters on the biochemical composition of starch in the tubers of the potato cultivar Sulev under conditions of the peat and soddy-low podzolic soils was studied. A decrease in the level of ground waters (up to 86 cm) and introduction of higher doses of K with a moderate amount of P and Cu (K240P60Cu) into the peat soil improved the starch physicochemical properties (size of the starch granules, relative viscosity, rate of sugar increase, content of ash and P), increased the tuber yield, and decreased their starchiness.-- Copyright 1975, Biological Abstracts, Inc.  
W76-07990

### 3D. Conservation In Domestic and Municipal Use

**THE IMPACT OF LARGE TEMPORARY RATE CHANGES ON RESIDENTIAL WATER USE,**  
Virginia Polytechnic Inst. and State Univ. Blacksburg. Dept. of Economics.  
For primary bibliographic entry see Field 6D.  
W76-07738

**THE WATER SUPPLY OF ROME,**  
College of Physicians of Philadelphia, Pa.  
For primary bibliographic entry see Field 4A.  
W76-07819

**WASTEWATER TREATMENT SYSTEM USES CALCINER,**  
For primary bibliographic entry see Field 5D.  
W76-08024

**STORM DRAINAGE AND URBAN REGION FLOOD CONTROL PLANNING,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08086

**PLANNING FOR THE REHABILITATION OF GRAVEL PITS,**  
Waterloo University, Ontario, Canada, School of Urban and Regional Planning.  
For primary bibliographic entry see Field 4A.  
W76-08087

**OPTIMAL SIZING OF URBAN FLOOD CONTROL SYSTEMS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08092

### 3E. Conservation In Industry

**CHEMICAL RECOVERY PROCESS FOR SPENT COOKING LIQUORS,**  
Hiroshima Inst. of Tech., Itsukaichi (Japan).  
For primary bibliographic entry see Field 5D.  
W76-07523

**ANALYSIS OF SOME PHYSICAL PROPERTIES OF POULTRY PROCESSING CHILLER EFFLUENT,**  
Richard B. Russell Agricultural Research Center, Athens, Ga.  
For primary bibliographic entry see Field 5D.  
W76-07534

**PERSPECTIVE ON USE OF FRESH WATER FOR COOLING SYSTEMS OF THERMOELECTRIC POWERPLANTS IN FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
G. H. Hughes.

Available from the National Technical Information Service, Springfield, Va. 22161, as PB-250 937, \$4.00 printed copy; \$2.25 microfiche. Water-Resources Investigations 43-75, December 1975. 30 p, 6 fig, 4 tab, 15 ref.

Descriptors: \*Cooling water, \*Thermal powerplants, \*Florida, Saline water, Freshwater, Evaluation, \*Water utilization, Water demand, Water conservation, Consumptive use, Heat transfer, Energy dissipation, Cooling towers.  
Identifiers: \*Cooling ponds, Once-through cooling.

In 1970, cooling systems of powerplants in Florida consumed about 106 mgd of water, mostly saline; however, powerplants in Florida increasingly are being located inland where saline water is not available for cooling purposes. In Florida, a cooling pond for a 1,000 megawatt nuclear powerplant operating at full load in summer consumes about 12.5 mgd of water. A cooling tower for a plant of the same size consumes about 14.8 mgd. Once-through cooling systems require 5 to 10 percent less water than cooling ponds, but the total withdrawal of water for this method is so large that it is practicable in Florida only along the coast where saline water can be used. Water consumption for power production in Florida could increase to 400 mgd by 1990 and 800 mgd by 2000. Demand also will increase greatly for other uses that require fresh water. The continued use of saline water for cooling systems of powerplants would help to conserve the fresh-water supply for these other uses. (Woodard-USGS)  
W76-07596

**CLOSED SYSTEM AND THE MODERN TECHNOLOGY (KUROZUDO SHISUTEMU TO GENDAI GIJUTSU),**  
Agency of Industrial Science and Technology, Tokyo (Japan).  
For primary bibliographic entry see Field 5D.  
W76-07624

**WASTELESS LIQUID TREATMENT SYSTEM FOR SURFACE COATING PLANTS (HYOMEN SHORI SHISETSU NI OKERU MUHAISUI SHORI SHISUTEMU NI TSUITE),**  
For primary bibliographic entry see Field 5D.  
W76-07625

**RECOVERY OF KRAFT WHITE LIQUOR,**  
For primary bibliographic entry see Field 5D.  
W76-07637

**CHLORINE DIOXIDE PULP BLEACHING SYSTEM,**  
For primary bibliographic entry see Field 5D.  
W76-07638

**HEAVY METAL RECOVERY METHOD AND TREATMENT OF PLATING LIQUID WASTE (MEKKI HAISUCHU NO JUKINZOKU KAISHU TO SONO SHORI),**  
For primary bibliographic entry see Field 5D.  
W76-07651

**RECOVERY OF CHEMICALS FROM SULFITE WASTE LIQUORS BY MEANS OF ELECTRODIALYSIS (CHEMIKALIENRUECKGEWINNUNG AUS SULFITABLAUGEN MIT DER METHODE DER ELEKTRODIALYSE),**  
For primary bibliographic entry see Field 5D.  
W76-07654

**IN-PLANT WASTE ABATEMENT,**  
Allied Chemical Corp., Morristown, N.J.  
For primary bibliographic entry see Field 5D.  
W76-07656

**THE SCAM (THE ENTERPRISES OF THE ELECTRO-MECHANICS COMP) AND THE RECYCLING OF INDUSTRIAL WATERS (LA SCAM ET LE RECYCLAGE DES EAUX INDUSTRIELLES),**  
For primary bibliographic entry see Field 5D.  
W76-07668

**THE WATER AND TOTAL OPTIMIZATIONS OF WET AND DRY-WET COOLING TOWERS FOR ELECTRIC POWER PLANTS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
T. E. Croley, V. C. Patel, and M. S. Cheng.  
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 856, \$9.75 in paper copy, \$2.25 in microfiche. IIRR Report No. 163, January 1975. 298 p, 97 fig, 8 tab, 61 ref, 7 append. OWRT C-4071 (No. 9015)(1)

Descriptors: \*Optimization, \*Design, \*Cooling towers, \*Powerplants, \*Cost-benefit analysis, Consumptive use, Model studies, Capital costs, Methodology, Operating costs, Computer models, Water conservation, Efficiencies.  
Identifiers: \*Dry-wet cooling towers, Wet cooling towers.

A detailed methodology for the assessment of thermodynamic and economic efficiency of combined dry-wet mechanical draft cooling towers for large electric power plants is developed. Operating costs are considered along with capital costs in the economic analysis. The application of the methodology is demonstrated for wet cooling

## WATER SUPPLY AUGMENTATION AND CONSERVATION—Field 3

### Conservation In Agriculture—Group 3F

towers as well as three different configurations of combined dryswet towers. Results indicate that: (1) fuel and water costs play a major role in the determination of the optimum size of both types of cooling systems, (2) use of a combination of dryswet towers saves a considerable amount of water and reduces fogging as compared to completely wet towers, (3) for many applications, combination towers are economically competitive or superior to conventional wet towers, (4) use of dryswet towers gives additional flexibility to site selection, (5) the water conservation, fog abatement potential, and overall economics of dry-wet cooling towers all depend on the manner in which the dry and wet portions are combined. The models developed are not restricted to any particular cooling tower design, and may be optimized to constrain either fogging or water consumption as well as economic performance. (Luedtke-Wisconsin). W76-07674

**WILL INDUSTRY MEET WATER QUALITY REQUIREMENTS,**  
For primary bibliographic entry see Field 5G.  
W76-07736

**THE PORI PROCESS: REGENERATION OF HYDROCHLORIC ACID FROM SPENT PICKLE LIQUOR,**  
Wean United, Inc. Warren, Ohio.  
For primary bibliographic entry see Field 5D.  
W76-07752

**CYANIDE COMPOUND RECOVERY BY IMPACT METHOD AND REUSE OF WASTEWATER (SHOGEKIHO NI YORU SHIAN-KAGOBUTSU NO KAISHU TO HAISSU NO SAIRIYO),**  
For primary bibliographic entry see Field 5D.  
W76-07753

**REFINERY WASTEWATER TREATMENT AND REUSE,**  
Frantz Co., Houston, Tex.  
For primary bibliographic entry see Field 5D.  
W76-07759

**WATER REUSE AND RECYCLE IN THE CDEHDED BLEACH SEQUENCE,**  
CIP Research Ltd., Hawkesbury (Ontario).  
For primary bibliographic entry see Field 5D.  
W76-07760

**GEOTHERMAL ENERGY DEVELOPMENT.**  
For primary bibliographic entry see Field 6E.  
W76-07865

**IMPORTANCE OF WATER QUALITY IN THE USE OF LARGE VOLUMES OF WATER FOR CONDENSER COOLING IN POWER STATIONS,**  
Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.  
For primary bibliographic entry see Field 5B.  
W76-08070

### 3F. Conservation In Agriculture

**THE EFFECT OF IRRIGATION ON THE DEVELOPMENT OF DESERT TAKYR SOILS, (IN RUSSIAN),**  
M. K. Charyev.  
*Probl Osvoeniya Pustyn'*. 6, p 11-15, 1973.

Descriptors: \*Irrigation, Soils, \*Crop production, Productivity, Deserts, \*Serozem, Arid lands, Fertilizers, Root system, Humus, Phosphorus, Nitrogen, \*Soil physical properties, Application rates, Soil treatment.  
Identifiers: \*Takyrs soils.

Productivity of takyr soils is improved by the efficient root system of the plants, irrigational siting and application of fertilizers. The content of humus, P and N is increased and an increment of the developed horizon depth is observed. All these factors improve the hydrophysical properties of the soils.—Copyright 1975, Biological Abstracts, Inc.  
W76-07580

**WATER RESOURCES OF PIERCE COUNTY, NEBRASKA,**  
Nebraska Univ., Lincoln. Conservation Co and Div.  
For primary bibliographic entry see Field 4A.  
W76-07598

**EFFECT OF SOIL MOISTURE AFTER YOUNG PANICLE FORMATION STAGE ON MINERAL COMPOSITION IN LOWLAND BROWN RICE, (IN JAPANESE),**  
National Food Research Inst., Tokyo, (Japan). H. Taira, H. Taira, and S. Inoue.  
Proc Crop Sci Soc Jpn. 43(2), p 135-143, 1974.

Descriptors: \*Soil moisture, \*Rice, Crop production, Iron, Phosphorus, Potassium, Manganese, Magnesium, Growth stages.  
Identifiers: Panicle formation, Brown rice, Soils(Mineral content).

The P, K, Mg, Mn and Fe content in rice were influenced by the soil moisture conditions. The P, K, Mg and Mn contents on dry matter basis decreased with decreasing soil moisture. With decreasing soil moisture, the P and Mg contents in ash decreased and the Fe content increased. The most affected component was Mg both on dry matter basis and in ash, followed by K on dry matter basis and Fe in ash.—Copyright 1975, Biological Abstracts, Inc.  
W76-07693

**WATER REQUIREMENT OF POTATO,**  
Uttar Pradesh Inst. of Agricultural Sciences, Kanpur (India). S. C. Yadav, and B. R. Tripathi.  
*Indian J Agric Sci.* 43(5), p 477-482, 1973.

Descriptors: \*Potatoes, Field crops, Vegetable crops, \*Irrigation effects, \*Water requirements, Irrigation efficiency.  
Identifiers: Solanum-Tuberosum L.

Irrigation of potato (*Solanum tuberosum L.*) at different moisture regimes had a significant effect on tuber yield. Under wet moisture regime the average yield was 352.76 q/quintals/ha when compared with 300.15 q/ha under moist 263.79 q/ha under dry regimes. The average consumptive use of water was 285.79, 309.90 and 345.50 mm under dry, moist and wet regimes, respectively. The consumptive use decreased with the delay in irrigation. For the wet regime that produced the best yields the irrigation requirement was 404.10 mm in 1966-67 and 313.10 mm in 1967-68. In 1967-68 only 86.28 mm total rainfall was received during the crop season. The irrigation efficiency decreased with an increase in the frequency of irrigation. The water-use efficiency was not influenced by differential irrigation treatments. It was 1.0 q/ha mm of water used/ha in both years. Copyright 1974, Biological Abstracts, Inc.  
W76-07703

**THE WILTING POINT AND AVAILABLE MOISTURE IN TROPICAL FOREST SOILS OF NIGERIA,**  
Ife Univ. (Nigeria). Dept. of Soil Sciences.  
For primary bibliographic entry see Field 2G.  
W76-07710

**COMPARISONS OF CALCULATED AND MEASURED CAPILLARY POTENTIALS FROM LINE SOURCES,**  
Southern Piedmont Conservation Research Center, Watkinsville, Ga.  
For primary bibliographic entry see Field 2G.  
W76-07768

**ASSESSMENT OF SOIL MOISTURE STORAGE FROM RAINFALL AND ITS UTILITY IN RABI CROP PLANNING IN HARYANA STATE,**  
Haryana Agricultural Univ., Hissar (India). For primary bibliographic entry see Field 2G.  
W76-07769

**PROBABILITY STUDIES OF AGRICULTURAL WATER MANAGEMENT IN HARYANA STATE,**  
Haryana Agricultural Univ., Hissar (India). For primary bibliographic entry see Field 2D.  
W76-07770

**AN IRRIGATION RATING FOR SOME SOILS IN ANTIGUA, W. I.,**  
Macdonald Coll., Montreal (Quebec). For primary bibliographic entry see Field 2G.  
W76-07963

**SOIL COVER OF THE SHERABAD STEPPE, (IN RUSSIAN),**  
For primary bibliographic entry see Field 2G.  
W76-07964

**THE CHEMICAL COMPOSITION OF ASPARAGUS SHOOTS AS Affected BY SOIL MULCHING, (IN ROMANIAN),**  
Institutul Agronomic, Bucharest (Rumania). For primary bibliographic entry see Field 2I.  
W76-07968

**POSSIBLE PHYSIOLOGICAL METHODS OF DIAGNOSING THE IRRIGATION TIME OF PEACH TREES, (IN RUSSIAN),**  
L. M. Man' Kovskaya-Tolstaya, and M. D. Kushnirenko.  
Izv Akad Nauk Mold SSR Ser Biol Khim Nauk 6, p 14-20, 1974.

Descriptors: \*Irrigation, \*Fruit crops, \*Peaches, Plant physiology, Orchards, Soil water, Leaves, Soil-water-plant relationships.

Data were obtained on the change of physiological processes of peach trees as influenced by the soil water content. A clear-cut relation between soil water content and the water deficit of shoots, water-retaining capacity of leaves and change of the content of dry matter is shown. The methods of establishing the time for irrigating peach orchards are described.—Copyright 1975, Biological Abstracts, Inc.  
W76-07989

**ESTIMATION OF EVAPOTRANSPIRATION FOR WATER BALANCE STUDIES IN A SEMI-ARID REGION,**  
Indian Agricultural Research Inst., New Delhi. Div. of Agricultural Physics.  
For primary bibliographic entry see Field 2D.  
W76-08067

**STUDIES ON THE OPERATION OF GOBIND-SAGAR RESERVOIR,**  
Regional Engineering Coll., Kurukshetra (India). For primary bibliographic entry see Field 4A.  
W76-08068

**A REALISTIC APPROACH TO RIVER BASIN DEVELOPMENT,**  
International Water Resources Association, New Delhi, India.

## Field 3—WATER SUPPLY AUGMENTATION AND CONSERVATION

### Group 3F—Conservation In Agriculture

For primary bibliographic entry see Field 4A.  
W76-08081

**EQUITY CONSIDERATIONS IN CONTROLLING NONPOINT POLLUTION FROM AGRICULTURAL SOURCES,**  
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5G.  
W76-08094

#### 4. WATER QUANTITY MANAGEMENT AND CONTROL

##### 4A. Control Of Water On The Surface

**PROCEEDINGS: SECOND WETLANDS CONFERENCE (HELD ON JANUARY 9, 1974 AT STORRS, CONNECTICUT),**  
Connecticut Univ., Storrs. Inst. of Water Resources.

For primary bibliographic entry see Field 6E.  
W76-07451

**RIVER POINT DIRECTORY FOR THE MISSISSIPPI RIVER-GULF COAST INLAND WATERWAYS SYSTEM,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 2L.  
W76-07458

**FOURMILE RUN LOCAL FLOOD-CONTROL PROJECT, ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 8B.  
W76-07469

**OUTLET WORKS FOR TAYLORSVILLE LAKE, SALT RIVER, KENTUCKY; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 8B.  
W76-07476

**TOPOGRAPHIC EXPRESSION OF SUPERIMPOSED DRAINAGE ON THE GEORGIA PIEDMONT,**  
Georgia State Univ., Atlanta. Dept. of Geology.

For primary bibliographic entry see Field 2J.  
W76-07553

**ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-SC,**  
Hydrologic Engineering Center, Davis, Calif.

W. K. Johnson, and D. W. Davis.

Training Document No. 7, November 1975. 141 p.

16 fig., 9 tab, 6 ref, 1 append.

Descriptors: \*Flood control, \*Computer programs, \*Flood plains, \*Floods, Flood protection, Flood damage, Reservoirs, Channel improvement, Levees, Floodproofing, Diversion, Diversion structures, Warning systems, Flood forecasting, Relocation, Flood discharge, Hydrology, Hydraulics.

This training document illustrated how a variety of structural and nonstructural flood control measures can be analyzed using computer program HEC-SC, 'Simulation of Flood Control and Con-

servation System.' This document was divided into three parts. The first part discussed some basic principles of flood control planning; part II illustrated the application of many of the principles described in part I; and the third part (appendix) contained supportive computer output developed as part of the application in part II. (Sims-ISWS)  
W76-07564

**EXTRACTION AND UTILIZATION OF SPACE ACQUIRED PHYSIOGRAPHIC DATA FOR WATER RESOURCES DEVELOPMENT,**  
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

For primary bibliographic entry see Field 4D.  
W76-07566

**ENVIRONMENTAL ASPECTS OF RUN-OFF AND SILTATION IN THE ANACOSTIA BASIN FROM HYPERALTITUDE PHOTOGRAPHS,**  
Maryland Univ., College Park.

For primary bibliographic entry see Field 4D.  
W76-07568

**RECONNAISSANCE OF THE WATER RESOURCES OF THE UPPER KLICKITAT RIVER BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,**  
Geological Survey, Tacoma, Wash.

D. R. Cline.  
Open-file report 75-518, 1976. 54 p, 6 fig, 11 tab, 15 ref, append.

Descriptors: \*Water resources, \*Surface waters, \*Groundwater, \*Indian reservations, \*Washington, Hydrologic data, Water quality, \*Streamflow, Springs, Water wells, Water yield, Water utilization, Irrigation.

Identifiers: \*Yakima Indian Reservation(Wash), \*Klickitat River basin(Wash).

The upper Klickitat River basin, covering 749 sq mi in the Yakima Indian Reservation, Wash., lies immediately east of the crest of the southern Cascade Range and is dominated on its western margin by 12,276-foot Mount Adams, a glacier-mantled volcano. The Klickitat River, which flows south to the Columbia River, discharges an annual flow of about 1,200 cfs at the point where it leaves the reservation, probably about 60 percent of this is groundwater discharge. Several streams provide irrigation water to about 5,600 acres in the Camas Prairie-Glenwood area. About 12,000 acre-ft of the water was delivered by Hellroaring Ditch in 1974. The area around Mount Adams yields considerably more water per square mile than the remainder of the basin because an average of 140 in of precipitation falls on the upper slopes of this mountain, mostly as snow. Less than 30 in falls in the southern part of the basin along the Klickitat River. Groundwater in large quantities (more than 400 cfs in the fall of 1974 and mostly from the Mount Adams area) discharges into the Klickitat River canyon in a 13-mile reach in the southern part of the reservation; about one-half of the water is discharged from large springs. The largest spring discharges about 40 cfs. (Woodard-USGS)  
W76-07594

**PRELIMINARY REPORT ON WATER AVAILABILITY IN THE LOWER SHIP CREEK BASIN, ANCHORAGE, ALASKA--WITH SPECIAL REFERENCE TO THE FISH HATCHERY ON FORT RICHARDSON AND A PROPOSED FISH-HATCHERY SITE NEAR THE ELMENDORF AIR FORCE BASE POWERPLANT,**  
Geological Survey, Anchorage, Alaska.

For primary bibliographic entry see Field 8I.  
W76-07595

**WATER RESOURCES OF PIERCE COUNTY, NEBRASKA,**  
Nebraska Univ., Lincoln. Conservation Co and Div.

R. E. Brogden, F. B. Shaffer, and R. A. Engberg. Nebraska Water Survey Paper Number 41, February 1976. 35 p.

Descriptors: \*Water resources, \*Surface waters, \*Groundwater, \*Water quality, \*Nebraska, Water supply, Agriculture, Irrigation, Data collections, Climatic data, Soils, Geology, Water yield, Aquifers, Streams.

Identifiers: Pierce County(Nebr).

Pierce County, in northeastern Nebraska, has an area of 576 square miles. Its economy is based on agriculture. Because precipitation is so variable, greater use of the more dependable sources of water supply is essential for maximum stabilization of agricultural productivity. This report describes the county's climate, soils, and water-bearing rocks insofar as they affect the availability and usability of streamflow and groundwater. It evaluates both types of water supply in quantitative and qualitative terms. Irrigated crops, mostly corn, totaled 15,600 acres during 1955-70. Water for irrigation was pumped from streams at 52 locations and from 146 wells. The average yield of irrigated corn ranged from 50 to 101 bushels per acre. (Woodard-USGS)  
W76-07598

**WATER-RESOURCES RECONNAISSANCE OF ST. GEORGE ISLAND, PRIBILOF ISLANDS, ALASKA,**

Geological Survey, Anchorage, Alaska.

G. S. Anderson.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-250 365/As \$3.50 printed copy; \$2.25 microfiche. Water-Resources Investigations 76-6, January 1976. 15 p, 4 fig, 2 tab, 2 ref.

Descriptors: \*Water resources, \*Surveys, \*Alaska, \*Surface waters, \*Groundwater resources, Water quality, Water supply, Available water, Aquifer characteristics, Islands, Lakes, Potable water, Salinity.

Identifiers: St. George Island(Alaska).

A hydrologic reconnaissance of St. George Island, Pribilof Islands, Alaska, was made in May 1974 to determine the feasibility of locating a source of water containing less sodium chloride than the present supply. The existing wells are apparently either too deep relative to sea level or too close to the ocean; they may be pumping from a transition zone between the freshwater and saltwater bodies. Other than a few lakes on the island, surface-water availability is limited. However, the presence of several freshwater springs suggests that groundwater of good quality does exist on the island. The island is relatively narrow, the rate of recharge is low, and the rocks are permeable; it is therefore concluded that the freshwater lens is thin. Fresh groundwater should be obtainable near the center of the island. However, production wells should be designed so as to skim freshwater from near the top of the lens. (Woodard-USGS)  
W76-07601

**SURVEY OF IRRIGATION CANAL ECOLOGICAL PARAMETERS INFLUENCING AQUATIC WEED GROWTH,**  
Bureau of Reclamation, Denver, Colo. Engineering and Research Center.

N. E. Otto.

Report No. REC-ERC-759, May 1975. 65 p. 11 fig., 22 tab., 52 ref., 2 append.

Descriptors: \*Aquatic weed control, \*Irrigation canals, Submerged plants, \*Colorado, \*California, \*Washington, Water chemistry, Nitrogen, Iron, Dissolved solids, Algae, Limiting factors, Rooted aquatic plants.

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

Comprehensive studies of water chemistry, hydrosoils, light penetration, and biological populations were conducted in 11 irrigation canals in Colorado, California, and Washington in order to determine the ecological factors that promote submerged weed growth. The plants were dominantly pondweeds with numerous subdominant species. Filamentous green algae also commonly grow among the weeds but are seldom as dominant as they are on concrete-lined canals. The most significant differences between canals supporting weeds and those that did not were that those without weeds had 70% less available nitrate-nitrogen, 71% less total iron, and 40% less total dissolved solids. All other measured parameters were statistically similar. Small statistical differences occurred in waters that had greater amounts of calcium, magnesium, and anions other than nitrates but the variations between individual ions were small. Dissolved oxygen levels were found to be at saturation or greater. Free carbon dioxide was seldom found because of the greater alkalinity of the waters, which had pH levels of 7.4 to 8.1. The indications are that measurable increases of mineral nutrient input was the major factor in causing greater incidence of weed growth and should be considered wherever irrigation return flows and urban sewage effluents enter irrigation waters. (Auen-Wisconsin).  
W76-07609

**LAND DRAINAGE AS A FACTOR IN 'RED TIDE' DEVELOPMENT,**  
Department of the Environment, Ottawa (Ontario). Shellfish Water Quality Div.  
For primary bibliographic entry see Field 5C.  
W76-07616

**WATER RESOURCES ISSUES AND THE 1972 UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT,**  
Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W76-07688

**EFFECT OF FLOODING ON THE REGENERATION OF SIX TROPICAL GRASSES AFTER DEFOLIATION,**  
Department of Primary Industries, Brisbane (Australia). Soil Conservation Branch.  
E. R. Anderson.  
Queensl J Agric Anim Sci. 31(1), p 25-29, 1974.

Descriptors: \*Grasses, Tropical regions, \*Flooding, Mortality, Growth rates, Australia, Vegetation regrowth.  
Identifiers: Biloela, Cenchrus-Ciliaris, \*Cultivars, Defoliation, Panicum-Colotarum, Panicum-Maximum, Tarewinnabar, Urochloa-Mosambicensis.

The effect of flooding immediately and 15 days after defoliation on the survival and growth of *Panicum coloratum*, *P. maximum*, *Urochloa mosambicensis* and 3 *Cenchrus ciliaris* cultivars ('Biloela', 'Molopo' and 'Tarewinnabar') was studied in a pot experiment at Mackay, Queensland Australia. Flooding immediately after defoliation was more deleterious to plant survival and production than flooding 15 days later. *P. coloratum* had greater flood tolerance than the other grasses.—Copyright 1975, Biological Abstracts, Inc.  
W76-07696

**FLOOD PLAIN INFORMATION: CLINTON RIVER AND PAINT CREEK, OAKLAND COUNTY, MICHIGAN.**

United States Lake Survey, Detroit, Mich.  
Prepared for the Water Resources Commission, Michigan Department of Natural Resources, and the Oakland County Planning Commission. April 1973. 36 p, 11 fig, 17 plates, 6 tab.

Descriptors: \*Floods, Flooding, \*Flood profiles, \*Flood stages, \*Flood plains, Obstructions to flow, Non-structural alternatives, Flood flow, River forecasting, Flood forecasting, Historic floods, Flood data, Peak discharge, Flow duration, Rivers, Ice jams, Flood plain zoning, Channel improvement, \*Michigan.  
Identifiers: \*Clinton River(MI), Paint Creek(MI), Pontiac(MI), Rochester(MI), Auburn Heights(MI), Intermediate Regional Flood, Standard Project Flood.

Most development along these streams is located in Pontiac, Rochester and Auburn Heights. Besides residences there is some industry and commerce, and considerable undeveloped land in the flood plains. Paint Creek with a drainage area of 71.8 sq mi joins Clinton River at Rochester. Clinton River drains 760 sq mi, 299 of which are below the study area's lower limits. Winter and spring floods result from heavy rains. In summer intense local thunderstorms can cause large floods. The April 1947 flood is the greatest known on the Clinton River, but adequate data concerning its severity is missing. The second largest flood in June 1968 had a recorded peak flow of 1,400 cubic ft/sec at Auburn Heights. On Paint Creek at Rochester the highest recorded flood in February 1968, with a peak flow of 918 cfs, resulted from combined heavy snowmelt and rainfall. In an Intermediate Regional Flood a peak discharge of 6,100 cfs can be expected on Clinton River at Oakland-Macomb County line with 2,355 cfs expected on Paint Creek at its confluence with Clinton River. Channel velocities for Clinton River may range from 6 to 11 ft/sec. This flood would peak in 14 hours and last 12 hours above bankfull. In a Standard Project Flood peak discharges of 25,000 and 10,950 cfs are predicted on Clinton River and Paint Creek, respectively. Channel velocities in Clinton River could range up to 16.7 ft/sec with 3 ft/sec in the overbank area. This flood would peak in 21 hours and last 72 hours. Many bridges would obstruct flood flow. Pontiac has spent millions to Clinton River channel within the city limits and has adopted subdivision ordinances restricting building adjoining open drains and streams. (Smith-North Carolina)  
W76-07720

**FLOOD PLAIN INFORMATION: NORTH YUBA AND DOWNIE RIVERS, DOWNEYVILLE, CALIFORNIA.**

Army Engineer District, Sacramento, Calif.  
Prepared for Sierra County, California, January 1975. 29 p, 15 fig, 17 plates, 8 tab.

Descriptors: \*Floods, Flooding, \*Flood forecasting, Overflow, Streamflow forecasting, Maximum probable flood, \*Flood profiles, Cloudbursts, Historic floods, Flood data, Flood frequency, Flood stages, \*Peak discharge, Flood peak, Flow duration, Flood damage, Deposition(Sediments), Flood plains, Obstructions to flow, Building codes, \*California.  
Identifiers: Downieville(CA), \*North Yuba River(CA), Downie River(CA), Standard Project Flood, Intermediate Regional Flood, Pauley Creek(CA).

The study area comprises the flood plains and immediately adjoining areas along North Yuba River between Goodyears Bar and the mouth of Slate Castle Creek (about 6 miles) and the Downie River from its mouth upstream to the mouth of Pauley Creek (1 mile). Lumbering, recreation, retail trade and Sierra County government are important to the economy. Except for downtown Downieville, development is very light. The approximate drainage area of the streams is 245 square miles. General rainfalls resulting from prolonged heavy rain over the tributary area and characterized by high peak flows of moderate duration can occur in the study area anytime from November through March. The largest flood on record occurred in 1963 when 19 inches of rain was deposited in the upper Yuba River Basin. Peak discharge on the

North Yuba River at lower end of study area was 40,000 cfs. Damage included the destruction of homes and commercial properties, roads, bridges and domestic water supply facilities. In an Intermediate Regional Flood it is predicted that peak flows of 50,000 cfs will be reached with water velocities ranging from 10 to 25 ft/sec in the main channel and up to 10 ft/sec in the overbank area. It is anticipated that flood peak will be reached in about 5 hours and with duration above flood stage of 9 hours. In a Standard Project Flood a peak discharge of 66,000 cfs is predicted with time of rise around 6 hours and the duration above flood stage about 14 hours. Two of the five bridges in the study area are considered obstructive to major floods. To date there are no existing or authorized Federal flood control structures that would reduce flood damage. (Smith-North Carolina)  
W76-07721

**FLOOD PLAIN INFORMATION: ROCK RIVER-POPLAR CREEK, LUVERNE AND VICINITY, MINNESOTA.**

Army Engineer District, Omaha, Nebr.  
Prepared for the City of Luverne, Rock County and the State of Minnesota. June 1972. 43 p, 17 fig, 6 plates, 8 tab.

Descriptors: \*Floods, \*Flood flow, \*River flow, \*Flood profiles, \*Peak discharge, \*Flood plains, Obstructions to flow, Flooding, Regional flood, Streamflow forecasting, Historic floods, Flood data, Ice jams, Tributaries, Land use, \*Minnesota.  
Identifiers: \*Rock River(MN), Poplar Creek(MN), Luverne(MN), Standard Project Flood, Intermediate Regional Flood.

The flood plain in this study area contains residential, commercial, industrial and agricultural developments which have been severely damaged by floods. Further urban expansion could worsen such damage. Poplar Creek which drains less than 3 sq mi is a tributary of Rock River, a tributary of the Missouri River, with a drainage area of 430 sq mi at Luverne. Major floods occur mainly in spring, with the highest flood occurring in 1969 when a peak discharge of 19,500 cubic feet per second was recorded. Snowmelt combined with rainfall is usually the cause of flooding. Since 1882, 6 floods of significant size have occurred. A flood in 1914 caused damages estimated at \$200,000. In past floods bridges have been washed out, thousands of turkeys have been killed, and many areas of the city of Luverne have been flooded. Floods rise to peak flow in 5 to 8 hours on the river with high velocities in the channel. In an Intermediate Regional Flood a peak discharge of 26,200 cfs on Rock River, and 2250 cfs on Poplar Creek are expected along with water velocities up to 5.6 ft/sec in the channel and up to 4.5 ft/sec in overbank areas. Most of 17 bridges in the area would be obstructive to flow. This flood would rise to peak in 5 hours and last 12 hours above critical stage. In a Standard Project Flood a peak discharge of 64,800 cfs and 6290 cfs are expected on Rock River and at the mouth of Poplar Creek respectively, with bridges being even more obstructive. This flood would reach peak in 8 hours and last 25 hours. A dam upstream has no flood control capacity, and there are no other flood control structures in the study area. (Smith-North Carolina)  
W76-07722

**FLOOD PLAIN INFORMATION: KETTLE CREEK, WAYCROSS AND WARE COUNTY, GEORGIA.**

Army Engineer District, Savannah, Ga.  
Prepared for Waycross and Ware County, Georgia, July 1971. 46 p, 23 fig, 21 plates, 15 tab.

Descriptors: \*Floods, \*Flood profiles, \*Flood plains, Flow characteristics, \*Flow duration, \*Flood damage, Hurricanes, Historic floods, Flood frequency, Flood stages, Peak discharge, Channels, Warning systems, Channel improvement, \*Georgia.

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

Identifiers: Waycross(GA), Ware County(GA), Kettle Creek(GA), Satilla River(GA), Intermediate Regional Flood, Standard Project Flood.

With a drainage area of 32 sq mi at its mouth, Kettle Creek has its headwaters in Cliffs Bay, southwest of Waycross, and flows in a northerly direction to its confluence with the Satilla River, north of Waycross. Streams in the study area, including 3 short tributaries, slope at an average rate of 5 feet/mile, flowing through a rapidly urbanizing area. Extensive commercial, industrial, and residential development exists in the flood plains. Channel dredging and maintenance have kept Kettle Creek in a well defined channel in the more developed areas. Twelve bridges and/or culverts, debris, shrubbery, and sand deposits can obstruct flood flows. In September 1964 Hurricane Dora dumped 7.03 inches of rain on Ware County and caused extensive damage to buildings and streets in Waycross. Installation of a gaging station at Cherokee Avenue in 1966 provides data on floods on Kettle Creek. The Intermediate Regional Flood is characterized by an estimated peak discharge of 3,505 cubic feet per second, at Cherokee Avenue, channel velocities of 8 ft/sec, and overbank velocities of 2 ft/sec. The IRF can be expected to rise 15 feet in 8 hours and remain above bankfull for 18 hours; 20 buildings and 750 acres would be flooded. The Standard Project Flood would have a peak discharge of 8,764 cfs and channel and overbank velocities of 13 and 3 ft/sec respectively. SPF would flood 56 buildings and 1370 acres. It would rise 16 feet in 12 hours and remain above bankfull for 24 hours. (Henley-North Carolina) W76-07723

#### FLOOD PLAIN INFORMATION: HURRICANE CREEK, ALMA AND BACON COUNTY, GEORGIA.

Army Engineer District, Savannah, Ga.  
Prepared for the City of Alma and Bacon County, Georgia, May 1971. 35 p, 8 fig, 28 plates, 14 tab.

Descriptors: \*Floods, \*Flood plains, Channels, \*Flood profiles, \*Flood forecasting, \*Flood stages, Hurricanes, Historic floods, Flood data, Peak discharge, Flow duration, Flow characteristics, Flood damage, Warning systems, \*Georgia.

Identifiers: Hurricane Creek(GA), Bacon County(GA), Alma(GA), Jeff Davis County(GA), Standard Project Flood, Intermediate Regional Flood.

The flood situation in the City of Alma and Bacon County, Georgia, along Hurricane Creek from about two miles downstream of the Highway 32 bridge to County Highway S608, a distance of about 9 miles, plus portions of two tributary streams along this reach of the Creek is examined. Hurricane Creek (drainage area 170 sq mi) slopes at an average of 2.8 ft/mi in the study area and flows through Alma in 3 or 4 poorly defined channels averaging 45 feet in width and 2 feet in depth. Tributary streams have channels averaging 10 feet wide and 3 feet deep. Except for several large subdivisions built in recent years near the flood plains between Highways 32 and 1, there is only scattered development in or near the flood plains. Shrubs, debris, sand and silt deposits, 5 bridges and culverts can obstruct flood flows during the Intermediate Regional Flood. Flows have exceeded bankfull 28 times since 1951 with a maximum discharge of 4,450 cubic feet per second occurring in September 1953 when Hurricane Florence dumped 9.08 inches of rain on the study area in six days. Hurricane Creek rose 5.5 feet in 8.4 hours and remained above bankfull for 6 days. Peak discharge during IRF and the Standard Project Flood would reach 12,500 and 31,400 cfs respectively. The IRF would rise 11 feet in 96 hours and would remain above bankfull for 8 days. Eleven structures and 2,100 acres would be flooded. Channel and overbank velocities would reach 4.6 and 2.1 ft/sec respectively. The SPF would typically rise 19 feet in 120 hours and remain above bankfull for 10 days, inundating 26

structures and 2,500 acres. (Henley-North Carolina) W76-07724

#### FLOOD PLAIN INFORMATION: LITTLE CRAB ORCHARD CREEK AND PILES FORK CREEK, CARBONDALE, ILLINOIS.

Army Engineer District, St. Louis, Mo.  
Prepared for Carbondale, Illinois, July 1970. 58 p, 15 fig, 16 plates, 12 tab.

Descriptors: \*Floods, Flooding, \*Flood profiles, \*Flood plains, Streamflow forecasting, Historic floods, Peak discharge, Flood peak, Flow duration, Reservoirs, Channel improvements, \*Illinois. Identifiers: Little Crab Orchard Creek(IL), Piles Fork Creek(IL), Carbondale(IL), \*Standard Project Flood, \*Intermediate Regional Flood, Big Muddy River(IL), Glades Creek(IL).

Carbondale lies between the watersheds of Little Crab Creek and Piles Fork with the northeast section of the city subject to flooding due to the low, flat terrain and the poor and inadequate drainage system. Only small amounts of commercial and residential development are on the flood plains, but the land is suitable to more development. Most floods occur in spring and summer and result from heavy rains. There are no stream gage records for these streams. The 1933 flood on Little Crab Orchard Creek was the biggest in memory and on Pile Fork the 1969 flood was quite substantial. In 1961 flooding in the lower reaches of both creeks occurred when water backed up from Big Muddy River. During an Intermediate Regional Flood peak discharges of 2000 cfs and 1600 cfs are expected on Little Crab Orchard Creek and Piles Fork respectively, and water velocities of 7 ft/sec in the channel and 2 to 3 ft/sec in the overbank. The flood would rise in about 10 hours and remain 14 to 16 hours above floodstage. In a Standard Project Flood a peak discharge of 3600 cfs on Little Crab Orchard Creek and 2700 cfs on Piles Fork is expected, with water velocities of 9 ft/sec in the channels and 3 ft/sec in overbank areas. Flood peak would be reached in 22 hours and waters would remain above floodstage from 23 to 24 hours. The five bridges and culverts of Little Crab orchard Creek would cause some obstruction to flow in major floods, as would the 14 bridges or culverts and one pipeline bridge across Piles Fork. Some channel improvement has been done on both creeks and more is expected. On Piles Fork there is the Carbondale Reservoir which was built for water supply and has a fixed spillway. (Smith-North Carolina) W76-07726

#### FLOOD INSURANCE STUDY: PLEASANTON, ALAMEDA COUNTY, CALIFORNIA, (PRELIMINARY REPORT).

Army Engineer District, San Francisco, Calif.  
Prepared for the Federal Insurance Administration, May 1972. 7 p, 13 plates, 2 tab.

Descriptors: \*Floods, \*Flood profiles, \*Flood peak, \*Flood plains, \*Flood plain insurance, Flooding, Streamflow forecasting, Dams, Channel improvement, \*California.

Identifiers: Pleasanton(CA), \*Pleasanton Canal(CA), Alameda County(CA), Arroyo Mocho(CA), Tassajara Creek(CA), \*Flood insurance, Chabot Canal(CA), Del Valle Dam(CA).

The City of Pleasanton is a residential community of 22,250 situated in the Amador Valley of Central Alameda County. A portion of Pleasanton's developed area is situated at the low point of the valley floor which is an historical flood plain fed by a number of natural streams. The contributing drainage area is 405 square miles. Data for this report was synthesized from basic characteristics as no stream flow gage is installed in the study area. Allowance has been made for channel improvements and construction of Del Valle Dam located 7 miles southwest of the city. The study area is di-

vided into 4 zones. Zone A would be subject to a 100 year flood; Zone B would be subject to a Standard Project Flood; Zone C is not subject to flooding; and Zone D must be studied further. Flood profiles included show the 100 year flood, a Standard Project Flood, and a 10 year flood. Floodways were developed for all areas considered and included sections of Arroyo de la Laguna, Arroyo Mocho, and Chabot Canal. Areas not considered but which appear to qualify for floodway analysis are the Pleasanton Canal, Tassajara Creek and another section of the Arroyo Mocho. Floodway computations were based on conditions assuming the floodway fringe was filled or otherwise blocked and that the floodway area was unobstructed. It was designed to pass the 100 year storm with approximately 1 foot rise. Velocities in the floodway fringe are expected to be 1 to 2 ft/sec. Future study by the City would likely revise this floodway. (Smith-North Carolina) W76-07726

#### FLOOD PLAIN INFORMATION: MINNESOTA RIVER AND TRIBUTARIES, MANKATO, NORTH MANKATO, LE HILLIER.

Army Engineer District, St. Paul, Minn.  
Prepared for Mankato, North Mankato, and Le Hillier, Minnesota. October 1973. 43 p, 35 fig, 19 plates, 5 tab.

Descriptors: \*Floods, \*Flood profiles, \*Peak discharge, Flood peak, \*Flood plains, Tributaries, \*Flood protection, Flooding, Flood flow, Streamflow forecasting, River forecasting, Storms, Historic floods, Flow duration, Rivers, Floodways, Obstructions to flow, Flood plain zoning, Levee, Dikes, Diversions, Erosion control, Channel improvement, \*Minnesota.

Identifiers: \*Minnesota River(MN), Mankato(MN), Le Hillier(MN), North Mankato(MN), \*Blue Earth River(MN), Standard Project Flood, Intermediate Regional Flood.

Four major floods in the last 22 years have caused heavy damages in the flood plains along the streams of this study, principally in Mankato, a city of 150,000 people. The Blue Earth River, with a drainage area of 3550 sq mi, is a tributary of the Minnesota River which drains 14,900 sq mi above Mankato. Storms most often occur in the spring when rivers can be fed by heavy snowmelt and rains, though in summer rainstorms of short duration and high intensity are common. The maximum spring flood occurred in 1965 when a peak discharge of 94,100 cubic ft/sec was reached. The highest summer flood, in 1908, had a peak discharge of 54,500 cfs. Dikes have been constructed prior to some floods and are generally removed after danger of flooding passes. It is possible to build these temporary structures because of the warnings which are given on snowmelt conditions. In an Intermediate Regional Flood a peak discharge of 105,000 cfs is predicted on the Minnesota River. This flood would rise in 6 days to peak and last 18 days at critical stage. The Standard Project Flood would have a peak discharge of 155,000 cfs. It would rise to peak in 11 days and last 20 days. A considerable portion of built-up areas would be subject to flooding from either flood. Aside from levees which have been constructed from time to time, a Federal Flood Control Project is now being constructed. Phase 1 consists of flood barriers with supporting interior drainage facilities to protect the entire flood prone areas in the three cities. It will provide protection against a flood of the 1965 height. Phase 2 would be a series of upstream reservoirs to provide protection against even larger floods. (Smith-North Carolina) W76-07727

#### FLOOD PLAIN INFORMATION: GRAND RIVER, GRAND RAPIDS, MICHIGAN AND VICINITY.

United States Lake Survey, Detroit, Mich.

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

Prepared for Water Resources Commission, Michigan Department of Natural Resources, and Grand River Watershed Council. 1972. 39 p, 23 fig, 14 plates, 6 tab.

**Descriptors:** \*Floods, \*Flood profiles, \*Flood stages, \*Flood plains, Flooding, Flood flow, Streamflow forecasting, Historic floods, Flood data, Peak discharge, Rivers, Levee, Floodwalls, \*Michigan.  
**Identifiers:** \*Grand River(MI), Grand Rapids(MI), Standard Project Flood, Intermediate Regional Flood.

The Grand River flood plain at Grand Rapids is highly developed and pressure is great to continue development of industrial, business and residential areas. The Grand River is fed by 6 major and numerous minor tributaries including the Rogue, Flat, Maple, Thornapple, Lookingglass, and Red Cedar Rivers with drainage areas of 255, 550, 970, 875, 290, and 402 sq mi, respectively. Only the Rogue joins the Grand River within the study limits. The Grand River has a drainage of 5063 sq mi above the lower limit of the study area and drains into Lake Michigan. Its relatively flat gradients increase the risk of floods which are usually caused by winter and spring rains coupled with snowmelt. The largest flood occurred in 1904 when a peak discharge of 54,000 cubic ft/sec was recorded and flooding reached disastrous proportions. The largest recent flood was in 1948 with a peak discharge of 42,200 cfs with the flood level 2.5 feet less than the 1904 flood. In an Intermediate Regional Flood a peak discharge of 61,000 cfs is expected with water velocities of 7.4 ft/sec in the main channel and 1.2 ft/sec in the overbank area. This flood would rise from critical stage to peak in 44 hours and last 98 hours above critical stage. During a Standard Project Flood a peak discharge of 151,000 cfs is expected with water velocities up to 9 ft/sec in the channel and 1.4 ft/sec in the overbank area. This flood would rise in 64 hours and remain 153 hours. In addition to obstruction caused by bridges in large floods there are four low dams across the river which obstruct flood flow somewhat. Floodwalls and levees, built after the 1904 flood, have helped protect Grand Rapids, but increase flood stages upstream. (Smith-North Carolina)  
W76-07729

#### FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER-SAUK RIVER-WATAB RIVER, VICINITY OF ST. CLOUD, MINNESOTA.

Army Engineer District, St. Paul, Minn.  
Prepared for St. Cloud Metropolitan Area Planning Commission, September 1974. 23 p, 12 fig, 13 plates, 6 tab.

**Descriptors:** \*Floods, \*Flood profiles, Rivers, Flood plains, Tributaries, \*Mississippi River, Floodwater, Flooding, River forecasting, Historic floods, Flood data, Peak discharge, Flow duration, Ice jams, Obstructions to flow, \*Minnesota.  
**Identifiers:** \*Sauk River(MN), \*Watab River(MN), St. Cloud(MN), Sartell(MN), Sauk Rapids(MN), Intermediate Regional Flood, Standard Project Flood.

Properties along banks of the 3 rivers vary in their state of development. Along the Mississippi steep banks have discouraged development, though there are some residences and commercial development in St. Cloud and Sartell. Along the Sauk heavily wooded sections have forced building to occur in open flood plain areas with more development expected. Along the Watab development is mostly beyond the flood plain. The Watab, which drains 85 sq mi, and the Sauk, with a drainage area of 970 sq mi, are tributaries of the Mississippi with a total drainage of 13,320 sq mi in or above this study area. Floods generally occur in spring though they can occur at anytime. Conditions which lead to flooding are frozen saturated ground, rapid snowmelt, and rain. In an Intermediate Regional Flood peak discharges of 57,500

cubic ft/sec on the Mississippi, 10,300 cfs on the Sauk and 1880 cfs on the Watab are predicted with water velocities ranging from 4 to 12 ft/sec. This flood would rise in about 11 days to flood peak and last 30 days. Most of the 14 bridges and culverts crossing the area streams are obstructive to this flood. Ice jams at bridges can cause backup and deepening of flood waters. During a Standard Project Flood peak discharges of 100,000 cfs, 20,300 cfs, and 5,000 cfs are predicted on the Mississippi, Sauk, and Watab Rivers respectively. This flood would rise to peak in 30 days and last about 50 days. Damage in either major flood could be extensive. Reservoirs at the Mississippi headwaters, built in the late 19th century, provide little protection from floods, and there are no existing flood ordinances to prevent building in flood prone areas. (Smith-North Carolina)  
W76-07729

#### FLOOD PLAIN INFORMATION: YALOBUSA RIVER AND TRIBUTARIES, GRENADE, MISSISSIPPI.

Army Engineer District, Vicksburg, Miss.  
Prepared for the City of Grenada, and Grenada County, Mississippi. March 1972. 41 p, 18 fig, 21 plates, 8 tab.

**Descriptors:** \*Floods, Flooding, \*Flood profiles, Frail lands, \*Flood plains, Dams, Regional flood, \*Flood flow, Streamflow forecasting, Flood data, Flood waves, Flow duration, Bank erosion, Water storage, Channel improvement, \*Mississippi.

**Identifiers:** \*Yalobusha River(MS), Grenada(MS), Riverdale Creek(MS), \*Grenada Lake project(MS), Perry Creek(MS), Batupan Bogue(MS), Grenada Dam(MS).

In and near the city of Grenada there has been some flood plain encroachment, mostly in the low lying areas near Batupan Bogue. Grenada is bounded by Perry Creek and Batupan Bogue to the east and south. Riverdale Creek enters Yalobusha River a short distance north of Grenada. Yalobusha River drains a total of 2050 square miles, 1320 sq mi of this above Grenada Dam which does much to protect the city. Batupan Bogue, the major tributary of Yalobusha River and the cause of most of the flood in the area, is undergoing adjustment in its stability and meanders through a bank carving process which is working upstream. Before completion of the Grenada Lake project in 1954, the largest flood occurred in 1948 with a peak discharge of 78,900 cubic feet/sec. A 1961 flood had a discharge of 50,000 cfs. An Intermediate Regional Flood could be caused by rain amounting to 6 inches in 6 hours and 9 inches in 24 hours. On Yalobusha River crest would be 2.4 ft higher than the 1961 flood and 1.5 ft on Batupan Bogue. A Standard Project Flood could result from rains varying from 9.7 inches in 6 hours to a total of 18.1 inches in 48 hours. It would be 6.1 feet higher than the 1961 flood with channel velocities of 18 ft/sec on Batupan Bogue and 11 ft/sec in Yalobusha River with velocities of 3 ft/sec in overbank areas. Heavy growth in some channels retards streamflow. Aside from the dam, few flood damage prevention measures have been undertaken, though the channel of Yalobusha River has been improved. (Smith-North Carolina)  
W76-07731

#### FLOOD PLAIN INFORMATION: CEDAR CREEK, ATHENS AND CLARKE COUNTY, GEORGIA.

Army Engineer District, Savannah, Ga.  
Prepared for Athens and Clarke County, Georgia, June 1969. 34 p, 8 fig., 13 plates, 13 tab.

**Descriptors:** \*Floods, \*Flood stages, \*Flash floods, \*Flood profiles, Historic floods, Flood data, Peak discharge, Flood duration, Flow characteristics, Flood damage, \*Bank erosion, \*Flood damages, Flood forecasting, \*Georgia.  
**Identifiers:** \*Cedar Creek(Ga), Clarke County(Ga), Athens(Ga), Intermediate Regional Flood, Standard project flood, Oconee River(Ga).

The study limits of Cedar Creek on the eastern outskirts of Athens are from its confluence with the Oconee River to its headwaters, a distance of about 6 miles. Tributary A which enters just above Old Lexington Road and Tributary B which enters 0.5 miles upstream are included. Average slope of the creek is about 37 ft/mile with a flood plain ranging in width from 100 to 300 ft. The upper reaches of Cedar Creek drain developed residential areas close to Tributary A. New development below Old Lexington Road is built high on valley slopes. Expansion of Athens is expected to increase pressure for building in the flood plain. The most severe flood in recent years occurred in May 1966. Over 9 inches of rain fell in a 5 hour period. Flash floods damaged homes and business establishments in the Athens area. Streets and culverts were heavily damaged. Bank erosion was severe along Cedar Creek. Using statistical studies of nearby streams the Intermediate Regional Flood and the Standard Project Flood are expected to have peak discharges of 3,620 and 10,800 cubic feet per second, respectively. The IRF would rise 13 feet in 9 hours and remain above bankfull for 16 hours, flooding 8 buildings and 135 acres. Channel and overbank velocities would reach 11 and 3 ft/sec., respectively. SPF would inundate 15 buildings and 160 acres and would rise 19 ft. in 12 hours and remain above bankfull for 22 hours. Channel and overbank velocities would reach 15 and 5 ft/sec., respectively. The Standard Project Storm could produce 19.9 inches of rain in 96 hours. (Henley-North Carolina)  
W76-07731

#### FLOOD PLAIN INFORMATION: FRESNO RIVER AND COTTONWOOD, LITTLE DRY, AND ROOT CREEKS, MADERA, CALIFORNIA.

Army Engineer District, San Francisco, Calif.  
Prepared for Madera County, CA, June 1973. 54 p, 27 fig, 38 plates, 9 tab.

**Descriptors:** Flooding, \*Flash floods, \*Flood profiles, \*Flood plains, Non-structural alternatives, Streamflow forecasting, Cloudbursts, Flood data, Flood frequency, Flood damage, Erosion, Deposition, Flood plain zoning, Flood plain insurance, Zoning, Levee, Dams, Channel improvement, Obstructions to flow, Floodways, \*California.

**Identifiers:** \*Fresno River(Ca), Cottonwood Creek(Ca), Little Dry Creek(Ca), Root Creek(Ca), Madera(Ca), \*Hidden Lake(Ca), Intermediate regional flood, Standard project flood.

Flood records of this study area show that damaging floods have occurred in 11 of the last 35 years. Lands are used primarily for irrigated crops, orchards, vineyards and grazing of cattle. Residential, commercial and manufacturing zones are present in Madera and the community is expanding into agricultural areas. The streams in the study area drain about 400 square miles. Floods in the past have resulted from prolonged rain, generally in late spring to early fall, but also in winter. Cloudburst storms can result in high peak flows, with short floodflow duration, greater than those of general flood-producing storms. Two stream gages have been in operation since 1915 and 1941. The largest floods on record occurred in 1955 and 1969 with peak flows of 17,500 and 17,300 cubic feet per second, respectively. In the 1969 flood residential damage was \$535,000. Hidden Lake, is scheduled to be completed on the Fresno River in 1975. It will serve as a multipurpose flood control, including a dam. In the Intermediate Regional Flood peak flows of up to 34,000 cfs can be expected without the dam and velocities of 4 to 8 feet per second. With the dam flows of 5000 cfs and velocities of 3 to 5 feet per second are forecast. A Standard Project Flood without the dam would result in flows of up to 49,000 cfs, and with the dam, flows of 21,000 cfs may be expected. Numerous bridges and culverts would be obstructions to flow in a Standard Project Flood without the dam in place, but with the dam these problems are reduced considerably. Madera Coun-

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4A—Control Of Water On The Surface

ty is adopting a flood plain ordinance and does have general zoning applicable to stream channels and river bottoms. (Smith-North Carolina) W76-07732

#### FLOOD PLAIN INFORMATION: MILL SLOUGH, OSCEOLA AND ORANGE COUNTIES, FLORIDA.

Army Engineer District, Jacksonville, Fla.  
Prepared for the Board of County Commissioners of Osceola County, June 1973. 37 p., 18 fig., 8 plates, 5 tab.

Descriptors: \*Floods, \*Flood profiles, \*Flood plains, \*Flood damage, Flow characteristics, Warning systems, Control structures, Channels, Flow duration, Peak discharge, Flood stages, Flood data, Storms, Hurricanes, Runoff, \*Florida. Identifiers: Osceola County(FL), Kissimmee(FL), \*Mill Slough(FL), Lake Tohopekaliga(FL), North City Ditch(FL), County Canal(FL), Orange County(FL), Intermediate Regional Flood, Standard Project Flood.

Located in Osceola County, Florida, (population 25,267) Mill Slough drains an area of about 14 sq mi and flows southerly from its origin in a swampy area for about 4 miles, discharging into Lake Tohopekaliga. Floods on Mill Slough are controlled to some extent by the water level of Lake Tohopekaliga which is regulated by the Central and Southern Florida Flood Control District. North City Ditch and County Canal, constructed by the City of Kissimmee to intercept runoff which flows from the northern drainage basin of Mill Slough and direct the flow around Kissimmee, do not prevent flooding. Flood plains in the upper reaches of Mill Slough are sparsely developed agricultural lands. The lower reaches in and near Kissimmee have flood plains well developed with commercial, residential, and light industrial uses. Vegetation and bridges can obstruct flood flows. Major floods have occurred during various seasons of the year; the greatest recorded flood occurring in October 1956 when 16.28 inches of rain fell in a 24 hour period. Damages were estimated at \$1 million. Flood flows can rise to extreme flood peak in a short time. The Intermediate Regional Flood and the Standard Project Flood would have peak discharges of 1,500 and 2,000 cubic feet per second at the mouth of Mill Slough. The IRF would have overbank velocities of up to 6 ft/sec and channel velocities of 3-7 ft/sec and flood 360 developed acres and 540 structures. The IRF would typically have maximum rate of rise of 0.3 ft/hour and have a duration of critical stage of 41 hours. The SPF would flood 900 structures and 640 acres of built up area. It would rise at 0.4 ft/hour and remain at critical stage for 55 hours. (Henley-North Carolina) W76-07733

#### FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, LOVELAND, COLORADO.

Army Engineer District, Omaha, Nebr.  
Prepared for Loveland, December 1971. 21 p., 9 plates, 2 tab.

Descriptors: \*Flood plains, \*Floods, \*Peak discharge, \*Flood profiles, Channels, Snowmelt, Flood flow, Flood data, Historic floods, Flood stages, Flow duration, Flow characteristics, Erosion, \*Colorado.

Identifiers: \*Big Thompson River(Co), Larimer County(Co), Loveland(Co), Buckhorn Creek(Co), Fall River(Co), Glacier Creek(Co), South Platte River(Co), Intermediate Regional Flood, Standard project flood.

Big Thompson River flows easterly from the mountains of the Colorado Front Range to join South Platte River southwest of Greeley, Colorado. That portion studied in this report extends from the eastern edge of the foothills to a point 8 miles downstream. Flowing through the city of Loveland (population 16,220) in Larimer

County, this portion of Big Thompson River drains an area of 509 sq mi and has an average slope of 19 ft/mi. The channel is from 4 to 10 ft deep and from 50 to 200 ft wide. Flood plain development includes agriculture, gravel mining operations, commercial facilities, and few residential acreages. Future growth in Loveland and Larimer County is expected to force further flood plain development. Elevated roadways and irrigation diversion structures will obstruct floodflows. The cause of floods is usually intense rainfall in the late spring and summer with the possibility of rainfall runoff being increased by snowmelt in May and June. The largest known flood occurred in August 1951 with an estimated peak discharge of 22,000 cubic feet per second at Loveland. This flood resulted in four deaths and \$602,000 damage to homes, crops, and highways. The Intermediate Regional Flood and the Standard Project Flood will have peak discharges of 19,000 and 44,000 cfs, respectively. Overbank velocities during IRF will be 1.5-3.5 ft/sec. Erosion will be the major source of future flood damage. (Henley-North Carolina) W76-07734

#### STRATEGIES FOR NATURAL RESOURCE DECISION MAKING: INTERIM REPORT TO THE NEW ENGLAND GOVERNOR'S CONFERENCE.

New England River Basins Commission, Boston, Mass.  
For primary bibliographic entry see Field 6B. W76-07735

#### SATELLITES HELPING TO SOLVE DOWN-TO-EARTH CIVIL ENGINEERING PROBLEMS.

For primary bibliographic entry see Field 7B. W76-07737

#### FLOOD PLAIN INFORMATION: NORTH FORK REPUBLICAN RIVER, WRAY, COLORADO.

Army Engineer District, Kansas City, Mo.  
Prepared for the Colorado Water Conservation Board, June 1969. 29 p., 14 fig., 8 plates, 4 tab.

Descriptors: \*Floods, \*Flood profiles, Control structures, \*Cloudbursts, \*Flood plains, \*Flash floods, Velocity, Flood flow, Peak discharge, Flood data, Historic floods, Flow duration, Channels, Dams, Reservoirs, Channel improvement, Levee, \*Colorado.

Identifiers: \*North Fork Republican River(Co), Wray(Co), Yuma County(Co), Chief Creek(Co), Intermediate regional flood, Standard project flood(Co).

Flood hazards along an 11 mile reach of the North Fork Republican River in the vicinity of Wray are evaluated. Although the total drainage area on the west edge of Wray is 1,216 square miles, only 59 sq. mi. actually contribute to surface runoff. Topographical barriers existing on the northern and southern edges of Wray have forced development expansion into the flood plain which has an average slope of 10 ft/mile and width of one-quarter mile. In 1934, Wray, a marketing center of 2,082 for the surrounding farming area, attempted to improve some of the bottom area for commercial development by straightening the river channel, building a levee, a diversion dam and a millrace. Business establishments are now located on both sides of the channel. Railroad tracks are also in the flood plain. Obstructions to floodflows include 10 bridges, highways, and railroads. Flooding from sidehill runoff in the town has been relieved since 1961 when the Soil Conservation Service completed a watershed treatment project which included six retarding dams. Flooding normally results from summer cloudbursts and is characterized by a very fast rate of rise and short durations. The Intermediate Regional Flood and the Standard Project Flood would have peak discharges of 4,200 and 11,700 cubic feet per second respectively, inundating the business area, railroad tracks and parts of U.S. Highway 34 and

385. Velocities vary markedly in the study reach. For an IRF channel velocities range from 2.59 to 6.89 ft/sec, overbank velocities from 0.93 to 2.33 ft/sec. Channel velocities for the SPF range from 3.63 to 7.95 ft/sec, overbank from 1.51 to 2.63 ft/sec. (Henley - North Carolina) W76-07739

PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS, Arizona Univ. Tucson. School of Renewable Natural Resources.  
For primary bibliographic entry see Field 2A. W76-07764

#### FLOOD ESTIMATION FROM SHORT RECORDS,

Queensland Irrigation and Water Supply Commission, Brisbane (Australia).

W.C. Boughton.

Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 102, No. HY3, Proceedings Paper 11996, p 241-253, March 1976. 5 fig, 7 tab, 9 ref.

Descriptors: \*Flood forecasting, \*Peak discharge, \*Floods, Flood frequency, Hydraulics, Hydrology, Rainfall, Forecasting, Estimating, Watersheds(Basins), Streamflow, \*Australia.

Identifiers: \*Flood estimation, Short records, Queensland(Australia).

Peak flood flows are highly correlated with the daily flows in which they occurred, and this relationship was used to develop a method of extending short flood records. The frequency distribution of daily flows, estimated from daily rainfalls by a rainfall-runoff model, was used with the short flood record to estimate the long-term distribution of floods. Tests were made on 8 catchments, 67 sq mi to 505 sq mi in area in Queensland, Australia, using 10 years of streamflow record in each case with daily rainfalls to estimate 30 to 35 years of floods. Log-normal and Log-Pearson III distributions were fitted to both estimated and actual flood series. The estimated 1-in-50 year and 1-in-100 year floods differed on average by less than 8% from the actual records. (Roberts-ISWS) W76-07771

#### APPLICATIONS OF REMOTE SENSING TO WATERSHED MANAGEMENT,

National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.

A. Rango.

Available from the National Technical Information Service, Springfield, Va 22161, as N75 24072, \$3.50 in paper copy, \$2.25 in microfiche. NASA TM X-70896, April 1975. 15 p, 5 fig, 1 tab, 30 ref.

Descriptors: \*Remote sensing, \*Watershed management, \*Water resources, Aerial photography, Satellites(Artificial), Aircraft, Floods, Floodplains, Snow cover, Runoff forecasting, Runoff, Land use, Watersheds(Basins), Physiographic provinces, Surface waters.

Present aircraft and satellite remote sensing systems (operational and experimental) are capable of contributing greatly to watershed management, primarily in the areas of snow mapping, surface water inventories, flood management, hydrologic land use monitoring, and watershed modeling. The two most widely applicable remote sensors are the Multispectral Scanner Subsystem on LANDSAT and the basic multispectral camera array flown on high altitude aircraft such as the U-2. Other aspects of watershed management will be investigated with future aircraft and spacecraft systems possessing higher resolutions and/or covering different spectral wavelength bands such as microwaves. The development of techniques for assessing soil moisture from remote sensing observations would provide a significant

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Control Of Water On The Surface—Group 4A

breakthrough in hydrology. As the technological advances in remote sensing of hydrological data continue to accelerate, so must the watershed management community expand its awareness of and its training in remote sensing techniques if these new tools are to be put to optimum use. (Sims-ISWS)  
W76-07791

#### THE WATER SUPPLY OF ROME, College of Physicians of Philadelphia, Pa. H. J. Abrahams.

Journal of American Water Works Association, Vol. 67, No. 12, p. 663-68 (1975). 6 p., 2 fig., 1 photo, 3 tab., 1 ref.

Descriptors: \*History, \*Water supply, \*Water distribution(Applied), \*Water management(Applied), \*Water resources development, Water supply development, Water control, Water conveyance, Water sources, Surface water availability, Supply, Resources development, Piping systems(Mechanical), Pipelines, Pipe flow, Surface waters.  
Identifiers: \*Rome(Italy), Tiber River.

As ancient Rome began to grow in importance and size the demand for water increased beyond what could be taken from the Tiber River. Thus aqueducts were built to bring water into the city from the surrounding hills and streams. The water supply was propelled into the city by gravity but only one ninth of the aqueducts were upon arches. An aqueduct would discharge into a delivery tank in the city at its own elevation. The water was then conveyed by lead pipes to water basins and public buildings. Repairs upon the aqueducts generally took place in the fall and spring. Such repairs were usually greatly needed inasmuch as one half of the aqueducts' water often failed to arrive in Rome. The quality of the water arriving in the city was governed by many factors. Some aqueducts brought much purer waters into Rome than others. The quantity and quality of Rome's water supply depended greatly upon the quality of the water commissioners who guided construction and allotment of the water supply. The water delivery system stands as one of Rome's finest contributions to public health. (Welch-Florida)  
W76-07819

#### FRAMEWORK AND RIVER BASIN STUDY PROGRAMS, LEVEL A AND LEVEL B STUDIES.

Corps of Engineers, Washington, D. C.  
For primary bibliographic entry see Field 6E.  
W76-07858

#### NAVIGATION OF RESTRICTED AREAS.

Corps of Engineers, Washington, D. C.  
For primary bibliographic entry see Field 6E.  
W76-07859

#### WATERSHED PROJECTS.

For primary bibliographic entry see Field 6E.  
W76-07866

#### DREDGING ON THE MISSOURI RIVER OXBOW LAKES.

For primary bibliographic entry see Field 6E.  
W76-07867

#### DYNAMICS OF THE ANNUAL GROWTH OF PINUS SYLVESTRIS L. IN THE TURGAI VALLEY IN CONNECTION WITH CLIMATIC FACTORS, (IN RUSSIAN),

Kustanai Pedagogical Institut (USSR).  
For primary bibliographic entry see Field 21.  
W76-07984

POLLUTION OF THE RUNOFF IN SEPARATE SEWER SYSTEMS, AND MEASURES FOR THE REDUCTION OF RAINWATER RUNOFF-GENERATED POLLUTION OF WATER BODIES (DIE VERSCHMUTZUNG DES ABFLUSSES IM TRENNVERFAHREN SOWIE MASSNAHMEN ZUR VERMINDERUNG DER GEWAESSERVERSCHMUTZUNG INFOLGE REGENWASSERLEITUNGEN),  
For primary bibliographic entry see Field 5B.  
W76-07997

#### RUBBER ROOF PROTECTS WATER FROM POLLUTANTS.

For primary bibliographic entry see Field 5F.  
W76-08003

POLLUTION OF WATER BODIES BY ARTIFICIAL RUNOFF OF RAINWATER POLLUTION BY WASTE WATER OF MIXED SEWERS (BELASTUNG DER GEWAESSER DURCH KUNSTLICHE ABLEITUNG VON NIEDERSCHLAEGEN. BELASTUNG DURCH GEWAESSER DER MISCHKANALISATION),  
For primary bibliographic entry see Field 5B.  
W76-08009

#### SYNTHETIC MONTHLY RUN-OFF RECORDS FOR UNGAUGED BRITISH CATCHMENTS,

Northumbrian River Authority, Gosforth (England).

B. M. J. Barton.  
Journal of the Institution of Water Engineers, Vol. 27, No. 3, p 149-162, May, 1973. 3 fig., 3 tab., 12 ref.

Descriptors: \*Model studies, \*Runoff, Computer programs, Topography, Soil types, Geology, Gaging, Snow, Rainfall-runoff relationships, Data collections.

Identifiers: Catchment records.

A technique whereby a synthetic record of monthly runoff may be generated for any British catchment, gaged or ungauged, has been developed. The technique involves the simultaneous stochastic generation from readily available data of monthly values of catchment precipitation, potential transpiration, and snowlag, which are then routed through a simple deterministic catchment model to yield the corresponding synthetic record of monthly runoff. Numerical values of the model parameters are obtained from a correlation with the topography, geology, and soil type of the catchment under investigation. The technique is intended primarily for use with high-speed electronic computers. A computer program incorporating both deterministic model and stochastic data generation procedures is used, enabling a semi-infinite synthetic catchment runoff record to be obtained. (Sandoski-FIRL)  
W76-08010

#### STORM DRAINAGE 'FILTERED' BEFORE DISCHARGE,

For primary bibliographic entry see Field 5G.  
W76-08032

#### QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PARTS 9 AND 10. COLORADO RIVER BASIN AND THE GREAT BASIN.

Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W76-08045

#### HYDRAULIC EFFECTS OF CHANGES IN BOTTOM-LAND VEGETATION ON THREE MAJOR FLOODS, GILA RIVER IN SOUTHEASTERN ARIZONA,

Geological Survey, Sacramento.  
For primary bibliographic entry see Field 4C.  
W76-08050

SURFACE-WATER RESOURCES OF THE TANGIPAHOA, TCHEFUNTA, AND NATALBANY RIVER BASINS, SOUTHEASTERN LOUISIANA, Geological Survey, Baton Rouge, La.  
L. D. Fayard, and D. J. Nyman.

Louisiana Department of Public Works, Baton Rouge, Water Resources Technical Report No 11, 1976. 49 p., 12 fig., 6 plates, 5 tab., 26 ref.

Descriptors: \*Water resources, \*Surface waters, \*Water quality, \*Hydrologic data, \*Louisiana, Streamflow, Water yield, Base flow, Low flow, Inflow, Groundwater movement, Chemical analysis, Data collections, Available water.

Identifiers: \*Tangipahoa River basin(La), \*Tchefuncta River basin(La), \*Natalbany River basin(La).

The Tangipahoa, Tchefuncta, and Natalbany River basins are in southeastern Louisiana, north of Lakes Maurepas and Pontchartrain. The combined average flow of the rivers is about 1,400 cfs, or 900 mgd. Rivers in the Tangipahoa and Tchefuncta basins have very good connection with the shallow aquifers and, therefore, have high sustained yields during periods of base flow. The lowest flow recorded in Tangipahoa River at Robert (1938-74) was 245 cfs, which is equivalent to a basin yield of 0.38 cubic foot per second per square mile of drainage area. The lowest flow recorded in Tchefuncta River near Folsom (1943-74) was 26 cfs, equivalent to 0.27 cubic foot per second per square mile. The quality of the water in both rivers is good, and dissolved solids are generally less than 50 mg/litre. These two rivers are good potential sources for municipal and industrial water supplies. Fecal coliform bacteria in undesirable amounts (greater than 200 colonies per 100 milliliters) have been detected in the two rivers, indicating periodic pollution by bacterial wastes. Streams in the Natalbany basin are poorly connected to the shallow aquifer. A 1-day low flow of 1.8 cfs (1943-74), equivalent to 0.023 cubic foot per second per square mile of drainage area was recorded at Baptist. Large withdrawals from these streams would not be feasible because of the large amount of storage that would be required. The water is slightly more mineralized than water from the other basins but is generally of good quality. (Woodard-USGS)  
W76-08056

WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1975, Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 7C.  
W76-08057

#### HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 1. RUNOFF, PRECIPITATION, AND STORAGE CHARACTERISTICS,

Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2A.  
W76-08059

#### HYDROLOGY OF THE NORTH CASCADES REGION, WASHINGTON: 2. A PROPOSED HYDROMETEOROLOGICAL STREAMFLOW PREDICTION METHOD,

Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2A.  
W76-08060

#### STUDIES ON THE OPERATION OF GOBINDASAGAR RESERVOIR,

Regional Engineering Coll., Kurukshetra (India).  
N. N. Pillai, and G. S. Sodhi.  
Indian Journal of Power and River Valley Development, Vol. XXV, No. 1, p 19-28, January 1975. 2 fig., 3 tab., 9 ref.

Descriptors: \*Reservoir operation, \*Irrigation, \*Power, \*Water supply, Hydrologic data, Reser-

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### Group 4A—Control Of Water On The Surface

voir storage, Reservoir releases, Farmers, Industries, \*Risks.  
Identifiers: \*Gobindsagar reservoir(India), Depletion period.

Bhakra Nangal Project has irrigation and power generation as the main objectives. Water released for irrigation is utilized in generation of power also. But since the irrigation requirements vary considerably and in some years there has developed acute shortage of water in the reservoir, drastic power cuts are imposed affecting the consumers adversely. It is suggested that the releases from Gobindsagar reservoir may be made so that the shortages are distributed throughout the depletion period. Based on the reservoir elevation reached at any time and the inflows expected in future, a graphical procedure is developed to calculate reservoir factors at the beginning of each ten-day period. This procedure will insure high firm power with the constraints of irrigation requirements. Also, early information can be given to the farmers and industrialists concerning the probable amount of water release and power generation in order to avoid uncertain risks. (Bell-Cornell)  
W76-08068

**A STUDY OF MAJOR RAIN STORMS OVER AND NEAR MAHI BASIN UP TO KADANA DAM SITE FOR THE EVALUATION OF PROBABLE MAXIMUM DESIGN STORM,**  
Institute of Tropical Meteorology, Poona (India).  
For primary bibliographic entry see Field 2B.  
W76-08069

**APPLICATION OF LINEAR PROGRAMMING OPTIMIZATION TO A NORTHERN ONTARIO HYDRO POWER SYSTEM,**  
Environment Canada, Ottawa, Ontario, Water Planning and Management Branch.  
D. W. Draper, and K. Adamowski.  
Canadian Journal of Civil Engineering, Vol. 3, No. 1, p20-31, March 1976. 7 fig, 1 tab, 7 ref.

Descriptors: \*Reservoir storage, \*Linear programming, \*Hydroelectric power, \*Comprehensive planning, Optimization, Regulation, Discharge(Water), Operations research, Simulation analysis, Computer programs, Streamflow, Costs, Constraints, Equations, Mathematical models, Systems analysis, Canada, Screening. Identifiers: Allocation.

A linear programming technique is used as an aid in selecting storage reservoirs for a hydroelectric power development system at the feasibility stage of investigation, and for maximizing system guarantee hydroelectric power by optimum regulation of discharge through power plants and from diversions for a selected time period. The linear programming technique is used as an allocation or screening model that provides information on system operation and response which would be useful in the preliminary design of hydroelectric power producing facilities and from which basic data and guidelines could be extracted for extending the investigation to the study of long-term system response by use of simulation models. The linear programming model has proved effective as a screening or allocation tool in the first phase of a modeling study conducted on one possible system for developing hydropower on the Albany River in Northern Ontario. The model lends itself to the type of application described, particularly if constraint and production functions can be linearized without introducing major complications in determining the matrix coefficients or large inaccuracies in the solutions. (Bell-Cornell)  
W76-08074

**DESIGN FLOOD SYNTHESIS BY EXCESS RAIN ROUTING,**  
Witwatersrand, Johannesburg, Africa, Department of Civil Engineering.  
For primary bibliographic entry see Field 2A.  
W76-08075

**FLOOD PEAK ESTIMATES FROM SMALL RURAL WATERSHEDS,**  
Federal Highway Administration, Washington, D.C.  
For primary bibliographic entry see Field 2A.  
W76-08077

**A REALISTIC APPROACH TO RIVER BASIN DEVELOPMENT,**  
International Water Resources Association, New Delhi, India.  
K. L. Rao.  
Working Paper No. 47, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 25 p, 2 fig, 1 tab.

Descriptors: \*River basin development, \*Planning, Irrigation, Water demand, Water supply, Flood control, Water balance, Water utilization, Soils, Optimum development plans.  
Identifiers: \*India, \*Developing countries, Food production, National water links, Economic restraints, Technical restraints.

River basin development leads to the development of the useful land regions of the world. The characteristics of river basins vary greatly from one another. In India, there are 14 major river basins, each exceeding 20,000 sq. km.; three of these are Himalayan rivers and the rest Peninsular rivers. There are 44 medium river basins and numerous rivers with smaller catchments. Major river basins constitute 83% of the geographical area of the country. This paper considers the planning needs for the major rivers in India. Three rivers, the Indus, the Ganga, and the Brahmaputra account for more than 50% of the total drainage area of the major rivers. Due to their size, it will be necessary to treat each important tributary of these large rivers as a subbasin on its own merits. Thus, the number of subbasins to be considered in the Indus, the Ganga, and the Brahmaputra will total up to about 140. It will be desirable to divide the basins into regions of approximately 10,000 sq. km., each bounded by tributary rivers, in order to accomplish a detailed assessment of water needs and planning. (Bell-Cornell)  
W76-08081

**INTEGRATED DEVELOPMENT OF THE VAR-DAR/AIXOS RIVER BASIN,**  
United Nations, New York, N.Y.  
P. G. D. Shallow.  
Working Paper No. 63, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 9 p.

Descriptors: \*United Nations, \*River basin development, Projects, \*Water resources development, Governments, Regulation, History, Multiple-purpose, Watersheds(Basins), Coordination, Planning, Reservoirs, Costs, Irrigation, Systems analysis.  
Identifiers: \*Greece, \*Yugoslavia, \*Vardar/Aixos River basin.

This paper is concerned with the implementation of an on-going project of the United Nations Development Programme in which the United Nations is assisting the Governments of Greece and Yugoslavia to prepare a phased program for the regulation and utilization of the water resources of a common river basin. It traces the history of the project and describes the characteristics of the basin. Details are given of the institutional framework under which the work is being undertaken, the progress of the studies to date, the future inputs of the United Nations, and the means being employed to insure coordination of the works at the project level. (Bell-Cornell)  
W76-08082

**AGGREGATE MODELING OF WATER DEMANDS FOR DEVELOPING COUNTRIES**

**UTILIZING SOCIO-ECONOMIC GROWTH PATTERNS,**  
Oklahoma University, Norman, Bureau of Water and Environmental Resources Research.  
For primary bibliographic entry see Field 6D.  
W76-08083

**SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
B. Eichert, and D. Davis.  
Technical Paper No. 44, March 1976. 32 p, 1 fig, 3 tab.

Descriptors: \*Flood control, \*Reservoirs, \*Size, \*Computer programs, Systems analysis, Simulation analysis, Planning, Operation and maintenance, Reservoir storage, Costs, Hydrology, Economics, Effects, Mathematical models.  
Identifiers: Sensitivity analysis.

This paper focuses upon reservoirs as flood control measures. Planning flood control reservoir systems requires analysis of basin-wide hydrology, individual reservoir and system operation, and system performance in reducing intensity of flooding. Sizing reservoir systems includes the major tasks of selecting system components from among competing alternatives and determining the flood control storage within each reservoir. Due to the large number of alternative systems possible in complex river basins and because of the complexity of evaluating each system, it is essential that a reasonably structured system formulation strategy be adopted as the framework for analysis. Application of a practical flood control reservoir system simulation model that yields detailed system operation of all components and summarizes hydrologic and economic performance and costs greatly assists in determining system performance. To perform the simulation, the model accepts data on (1) historical or synthetic flood hydrology, (2) reservoir system storage and operating criteria, (3) reservoir costs, and (4) damage potential at system control points. Discussed in the scope of reservoir system formulation, modeling flood control systems, criteria and strategies for system formulation; the concepts are illustrated with applications in recent systems studies. (Bell-Cornell)  
W76-08085

**STORM DRAINAGE AND URBAN REGION FLOOD CONTROL PLANNING,**  
Hydrologic Engineering Center, Davis, Calif.  
D. Davis.  
Technical Paper No. 40, October 1974. 44 ref.

Descriptors: \*Storm water, \*Management, \*Storm drains, \*Planning, \*Flood control, Urban hydrology, Rainfall-runoff relationships, Urbanization, Effects, Watersheds(Basins). Analytical techniques, Performance, Design storm, Costs, Flood plains.  
Identifiers: Alternatives, Public participation.

Stormwater management systems are expensive and have performed well in some instances and poorly in others. The investment in storm drains is three times the investment in works to protect the flood plain, and the annual damages from inadequate storm drains may well exceed the damage inflicted upon urban flood plains. Storm drainage systems are a major planning task because of the large variety of management alternatives that are possible and because the impact of works on communities can be very great. Competition for space and funds and good planning require that drainage systems be considered integral parts of a broader urban design and that advantage be taken of all feasible joint development opportunities. In addition, there is growing concern that many problems should be amenable to nonstructural solutions that do not necessarily require large scale disturbance of the landscape. This paper (1) defines the subject area and describes its characteristics, (2) reviews past concepts in storm

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### Groundwater Management—Group 4B

drainage, (3) describes the current context of planning these systems (4) describes the alternatives available and the implementation requirements, and (5) discusses institutional factors including the federal interest, and concludes with some observations on current planning approaches. (Bell-Cornell)  
W76-08086

**PLANNING FOR THE REHABILITATION OF GRAVEL PITS,**  
Waterloo University, Ontario, Canada, School of Urban and Regional Planning.  
G. Mulumoottil, and R. Farvolden.  
Water Resources Bulletin, Vol. 11, No. 3, p 599-604, June 1975. 2 fig, 5 ref.

Descriptors: \*Planning, \*Recreation, \*Lakes, Surface waters, Groundwater, Soils, Land use, Topography, Canada.  
Identifiers: \*Gravel pits, \*Urban areas.

By field investigations and planning, it is profitable to rehabilitate gravel pits as recreational lakes in urban areas. Some of the important aspects to be considered are topography, soil, surface water and groundwater. A case study is presented and some general guidelines in the rehabilitation process are given. This kind of a use for derelict land is important at the present time as there is a growing demand for recreational lakes in urban areas. (Bell-Cornell)  
W76-08087

**METHODOLOGY FOR THE SELECTION AND TIMING OF WATER RESOURCES PROJECTS TO PROMOTE NATIONAL ECONOMIC DEVELOPMENT,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6B.  
W76-08091

**OPTIMAL SIZING OF URBAN FLOOD CONTROL SYSTEMS,**  
Hydrologic Engineering Center, Davis, Calif.  
D. W. Davis.  
Technical Paper No. 42, March 1974. 16 p, 5 fig, 1 tab, 9 ref.

Descriptors: \*Flood control, \*Water resources, \*Simulation analysis, \*Computer models, \*Urbanization, Planning, Hydrology, Size, \*Optimization, Methodology, Drainage, Costs, Reservoirs, Storage, Pumping plants, Diversion, Rainfall-runoff relationships, Equations, Mathematical models, Systems analysis.  
Identifiers: Economic analysis, Benefit maximization, Social costs, Minimization, Automatic search procedure, Univariate gradient procedure, Newton-Raphson convergence procedure, Systems engineering.

Optimal sizes for components of urban flood-control systems can be determined from a detailed simulation analysis controlled by an optimization methodology. Flood-control measures within urban areas frequently consist of complex systems of detention storage reservoirs, channel modifications, levees, land-use controls, flood proofing, and pumping facilities. The optimal size of each of these system components depends on the system interaction with other components and the hydrologic, economic, environmental, and other performance outputs of the system. A technique has been developed and programmed for an existing simulation model that automatically determines the sizes of urban flood-control components of detention storage, flow diversions, and pumping plants, the objective being to maximize system net benefits subject to accomplishment of hydrologic performance targets and to minimize social costs. The system is simulated using hydrologic data, component cost and performance functions, and flow damage information at damage

centers. Utilized also are an automatic search procedure—the univariate gradient procedure—and the Newton-Raphson convergence procedure. (Bell-Cornell)  
W76-08092

**THE USE OF OVERWINTER DRAW DOWN FOR AQUATIC VEGETATION MANAGEMENT,**  
Wisconsin Univ. Extension, Madison. Environmental Resources Unit.  
For primary bibliographic entry see Field 2I.  
W76-08093

**PROBLEMS IN FORECASTING WATER REQUIREMENTS,**  
Research Inst. for Water Resources Development, Budapest (Hungary).  
For primary bibliographic entry see Field 6D.  
W76-08098

**A SIMULATION MODEL FOR OPERATING A MULTIPURPOSE MULTIRESERVOIR SYSTEM,**  
Acres Consulting Services Ltd., Niagara Falls (Ontario).  
O. T. Sigvaldason.  
Water Resources Research, Vol. 12, No. 2, p 263-278, April 1976. 8 fig, 3 tab, 40 ref.

Descriptors: \*Multiple-purpose reservoirs, \*Reservoir operation, \*Simulation analysis, \*Optimum development plans, Water policy, Assessment, River basins, Reservoir storage, Networks, Equations, Mathematical models, Systems analysis, \*Canada.  
Identifiers: \*Trent River basin(Ontario Canada), Out-of-kilter algorithms.

Described is a simulation model used for assessing alternative operating policies for the Trent River system in Ontario, Canada. The Trent basin has numerous reservoirs (48 were represented in the model). The reservoir system is used for flood control, water supply, hydropower, and augmenting flows through the canal system during the summer period. The need for assessing alternative policies arose from growing conflicts in recent years over satisfying all of the many water-based needs of the basin. The simulation model aided in assessing the impact of alternative policies. Every reservoir was subdivided into five storage zones (variable temporally). A time-based rule curve was prescribed to represent ideal reservoir operation. Ranges were prescribed for channel flows, which were dependent on water-based needs. The underlying concept of the model was the mathematical representation of the chief operator's perception of 'optimum' operation and the derivation of this solution using a nested optimization submodel. 'Penalty coefficients' were assigned to those variables which represented deviations from ideal conditions. Different operational policies were simulated by representing the entire reservoir system in 'capacitated network' form and deriving optimum solutions for individual time periods with the 'out-of-kilter' algorithm. The algorithm was computationally efficient, simplified model development, and permitted flexibility in readily using the model for a wide range of reservoir configurations and operating policies. (Bell-Cornell)

W76-08099

**THE DEVELOPMENT OF WATER MULTIPLIER IMPACTS FROM INPUT-OUTPUT ANALYSIS: AN EMPIRICAL EXAMPLE FROM BOULDER, LARIMER, AND WELD COUNTIES, COLORADO,**  
Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 6D.  
W76-08100

### 4B. Groundwater Management

**CLAM SURVIVAL IN CHLORINATED WATER,**  
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.  
For primary bibliographic entry see Field 5G.  
W76-07481

**A SIMPLIFIED APPROACH FOR THE ANALYSIS OF UNSTEADY FLOW TO A CAVITY WELL,**  
Punjab Agricultural Univ., Ludhiana (India). Dept. of Soil and Water Engineering.  
For primary bibliographic entry see Field 2F.  
W76-07561

**ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, 1975—A BASIC-DATA REPORT,**  
Geological Survey, Albuquerque, N. Mex.  
R. R. Cruz.  
Open-file report, March 1976. 39 p, 9 fig, 5 tab, 2 ref.

Descriptors: \*Water wells, \*Withdrawal, \*Water level fluctuations, \*Water quality, \*New Mexico, Military reservations, Water supply, Basic data collections, Hydrology, Drawdown, Groundwater recharge, Chemical analysis, Aquifers.  
Identifiers: \*White Sands Missile Range (N Mex).

This report presents water-resources information that was collected at White Sands Missile Range, N. Mex., during 1975 by personnel of the U.S. Geological Survey. Data on groundwater pumpage and resulting water-level fluctuation, chemical quality, and precipitation are summarized. The data are part of the continuing water-resources basic-data collection program sponsored by the Facilities Engineering Directorate, White Sands Missile Range. Groundwater pumpage totaled 714,580,000 gallons (preliminary figures) at the Post Headquarters well field in 1975. This was 42,646,000 gallons less than pumpage in 1974. Water-levels declined in six of the nine supply wells in the Post Headquarters well field during the period of December 1974 to December 1975. The declines ranged from 21.00 feet to less than one foot. The annual total rainfall was 9.12 inches, which is 1.61 inches below the yearly average. There was no significant change in water quality for samples collected during 1975 compared with 1974 samples. (Woodard-USGS)  
W76-07588

**AVAILABILITY OF GROUND WATER IN THE PEMIGEWASSET AND WINNIPESAUKEE RIVER BASINS, CENTRAL NEW HAMPSHIRE,**  
Geological Survey, Concord, N. H.  
For primary bibliographic entry see Field 7C.  
W76-07589

**RECONNAISSANCE OF THE WATER RESOURCES OF THE UPPER KLICKITAT RIVER BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 4A.  
W76-07594

**PRELIMINARY REPORT ON WATER AVAILABILITY IN THE LOWER SHIP CREEK BASIN, ANCHORAGE, ALASKA—WITH SPECIAL REFERENCE TO THE FISH HATCHERY ON FORT RICHARDSON AND A PROPOSED FISH-HATCHERY SITE NEAR THE ELMENDORF AIR FORCE BASE POWERPLANT,**  
Geological Survey, Anchorage, Alaska.  
For primary bibliographic entry see Field 8I.  
W76-07595

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4B—Groundwater Management

**WATER RESOURCES OF PIERCE COUNTY, NEBRASKA,**  
Nebraska Univ., Lincoln. Conservation Co and Div.  
For primary bibliographic entry see Field 4A.  
W76-07598

**AQUIFER TESTS IN THE SUMMIT REACH OF THE PROPOSED CROSS-FLORIDA BARGE CANAL NEAR OCALA, FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 2F.  
W76-07599

**WATER-RESOURCES RECONNAISSANCE OF ST. GEORGE ISLAND, PRIBILOF ISLANDS, ALASKA.**  
Geological Survey, Anchorage, Alaska.  
For primary bibliographic entry see Field 4A.  
W76-07601

**GEOHYDROLOGY OF THE LAKE AREA AT KATHRYN ABBEY HANNA PARK, JACKSONVILLE, FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 2F.  
W76-07602

**SPRINGS OF PENNSYLVANIA,**  
Geological Survey, Harrisburg, Pa.  
For primary bibliographic entry see Field 2F.  
W76-07604

**RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, MAY 1974,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 5A.  
W76-07606

**RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, AUGUST 1974, AND CHEMICAL MONITORING FROM JULY 1972 TO JUNE 1974,**  
Geological Survey, Denver, Colo.  
For primary bibliographic entry see Field 5A.  
W76-07607

**PROBLEMS RELATED TO THE RENEWED GROUNDWATER LEVEL RISE IN PREVIOUS MINING AREAS AS ILLUSTRATED BY THE SOUTHERN LUSATIA EXAMPLE (PROBLEME DES GRUNDWASSERWIEDERANSTIEGS IN EHEMLIGEN BERGBAUGEBIETEN AM BEISPIEL DER SUED-LAUSITZ),**  
For primary bibliographic entry see Field 5B.  
W76-07663

**APPLICATION OF THE WINTERS DOCTRINE: QUANTIFICATION OF THE MADISON FORMATION,**  
For primary bibliographic entry see Field 6E.  
W76-07808

**HEAVY METALS AS TRACE CONSTITUENTS IN NATURAL GROUNDWATERS AND POLLUTED,**  
Kiel Univ. (West Germany). Geologisch-Palaeontologisches Institut und Museum.  
For primary bibliographic entry see Field 5A.  
W76-07978

**GEOLGY AND GROUND-WATER RESOURCES OF HETTINGER AND STARK COUNTIES, NORTH DAKOTA,**  
Geological Survey, Bismarck, N. Dak.  
H. Trapp, Jr., and M. G. Croft.

North Dakota State Water Commission, Bismarck, County Ground-Water Studies 16--Part I, 1975. 51 p, 14 fig, 4 plates, 4 tab, 52 ref.

Descriptors: \*Groundwater resources, \*Water quality, \*Aquifer characteristics, \*Hydrogeology, \*North Dakota, Hydrologic data, Water yield, Water utilization, Maps, Water wells, Water level fluctuations, Chemical properties, Available water, Geology.  
Identifiers: Hettinger County(N Dak), Stark County(N Dak).

The sedimentary rocks of Paleozoic, Mesozoic, and Cenozoic age in Hettinger and Stark Counties, N. Dak., on the south-central flank of the Williston structural basin, are about 14,000 feet thick. They are gently folded into north-plunging anticlines and synclines. The Fox Hills and basal Hell Creek aquifer system underlies the entire area at depths greater than 1,100 feet. The water in this system is a sodium bicarbonate type with a dissolved-solids concentration of 1,310 to 1,540 mg/litre. The upper Hell Creek and lower Cannonball-Ludlow aquifer system underlies all of Hettinger and Stark Counties. The water contains a sodium bicarbonate type with a dissolved-solids concentration ranging from 1,450 to 1,890 mg/litre. Water in the basal sandstone member is generally a sodium bicarbonate type with a dissolved-solids concentration ranging from 704 to 1,470 mg/litre. The Sentinel Butte aquifer system underlies most of Stark County. The water is generally of a sodium sulfate type. Dissolved-solids concentration of the samples ranged from 378 to 11,700 mg/litre. Approximately 6,800 acre-ft of water was obtained from groundwater and surface-water sources in 1969. Groundwater sources furnished about 40 percent of the total water supply. (Woodard-USGS)  
W76-08043

**KARST AND PALEOHYDROLOGY OF CARBONATE ROCK TERRANES IN SEMIARID AND ARID REGIONS WITH A COMPARISON TO HUMID KARST OF ALABAMA,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 2F.  
W76-08044

**ARTIFICIAL RECHARGE THROUGH A WELL IN FISSURED CARBONATE ROCK, WEST ST. PAUL, MINNESOTA,**  
Geological Survey, St. Paul, Minn.  
H. O. Reeder, W. W. Wood, G. G. Ehrlich, and R. J. Sun.  
Available from Supt. of Documents, GPO, Wash., D.C. 20402, price \$1.65. Water-Supply Paper 2004, 1976. 80 p, 28 fig, 16 tab, 55 ref.

Descriptors: \*Artificial recharge, \*Injection wells, \*Aquifer characteristics, \*Aquifer testing, \*Minnesota, Carbonate rocks, Methodology, Observation wells, Feasibility studies, Groundwater recharge, Underground storage, Hydrogeology, Water yield, Water level fluctuations, Groundwater movement, Tracking techniques.  
Identifiers: \*West St. Paul(Minn), Prairie du Chien Group, Jordan Sandstone.

Tests were made near St. Paul, Minn., to determine the feasibility of artificially recharging a consolidated aquifer by well injection. The formations of primary concern at the recharge experiment site are the Prairie du Chien Group and the underlying Jordan Sandstone, which is the major aquifer in the area. The Prairie du Chien is made up primarily of well-fractured dolomite, which contains solution openings. The Jordan Sandstone is more uniform and is considered to be homogeneous on a large scale, although small fractures and variations in material are recognized locally. The two layers are hydraulically interconnected and are artesian. A head difference of 2 ft is noted between water levels in a well open only in the dolomite and in a nearby well open only in the sandstone. For the tests, a production well was installed in the Prairie

du Chien Group, and observation wells were installed nearby, both in the Prairie du Chien and in the Jordan Sandstone. Pumping tests were performed before and after injection, and the injection test itself involved recharge of 2,754,000 gallons occurring at a rate of about 100 gpm for 20 days. Air entrainment during injection was avoided by use of a small-diameter pipe, in which pipe friction was sufficient to maintain positive pressure throughout the column. The injection test demonstrated that it is hydrologically feasible to recharge the Prairie du Chien Group and the Jordan Sandstone artificially through wells completed in the Prairie du Chien Group. (Woodard-USGS)  
W76-08046

**EVALUATION OF GROUND-WATER CONTAMINATION FROM CLEANING EXPLOSIVE-PROJECTILE CASINGS AT THE BANGOR ANNEX, KITSAP COUNTY, WASHINGTON, PHASE II,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 5B.  
W76-08048

**SUMMARY APPRAISALS OF THE NATION'S GROUND-WATER RESOURCES--TEXAS-GULF REGION,**  
Geological Survey, Austin, Tex.  
For primary bibliographic entry see Field 2F.  
W76-08051

**GEOHYDROLOGIC RECONNAISSANCE OF THE IMPERIAL VALLEY, CALIFORNIA,**  
Geological Survey, Reston, Va.  
O. J. Loeltz, B. Irelan, J. H. Robison, and F. H. Olmsted.  
Available from Superintendent of Documents, Government Printing Office, Washington, D. C., 20402, \$2.85 in paper copy. Professional Paper 486-K, 1975. 54 p, 12 fig, 2 plates, 5 tab, 53 ref.

Descriptors: \*Groundwater resources, \*Aquifer characteristics, \*Well data, \*Water quality, \*Deserts, California, Projecting, Water demand, Irrigation, Data collections, Hydrogeology, Groundwater potential, Chemical analysis.  
Identifiers: \*Imperial Valley(Calif).

The Imperial Valley in southern California is the largest desert irrigation development in the United States. Half a million acres of otherwise parched desert lands have been transformed into one of the most productive agricultural areas in the Nation by the importation of Colorado River water. Recognizing that the ever increasing demands for Colorado River water might exceed the available supply, the objectives of this report on Imperial Valley were (1) to describe the geology in relation to the occurrence of groundwater, (2) to define the hydraulic characteristics (transmissivity and storage) of the aquifers, (3) to determine the sources of groundwater, (4) to determine the direction of movement of groundwater, (5) to determine the principal means by which groundwater is discharged, (6) to determine the chemical quality of the groundwater in various parts of the system, and (7) to relate differences in chemical composition of the water to differences in the sources of recharge and to man-caused and natural processes. More than 300 wells were inventoried. (Woodard-USGS)  
W76-08052

**AVAILABILITY OF GROUND WATER FOR IRRIGATION ON THE KEKAHAMANA COASTAL PLAIN, ISLAND OF KAUAI, HAWAII,**  
Geological Survey, Honolulu, Hawaii.  
R. J. Burt.  
Hawaii Division of Water and Land Development, Honolulu, Report R-53, January 1976. 79 p, 14 fig, 3 tab, 13 ref.

## WATER QUANTITY MANAGEMENT AND CONTROL—Field 4

### Watershed Protection—Group 4D

**Descriptors:** \*Groundwater resources, \*Irrigation, \*Sugarcane, \*Hawaii, \*Hydrologic data, Hydrogeology, Irrigation wells, Aquifer characteristics, Withdrawal, Water yield, Artesian heads, Drawdown, Saline water intrusion, Sea water, Groundwater recharge, Evaluation.  
**Identifiers:** \*Kauai(Hawaii).

The Kekaha-Mana coastal plain on the southwest side of the island of Kauai, Hawaii is underlain by a basaltic aquifer from which individual wells or shafts yield as much as 22 mgd. The basaltic aquifer is recharged in a highland area adjacent to the plain and is overlain by about 200 feet of poorly permeable sedimentary formations that retard natural discharge, creating artesian conditions. Pumpage from wells and shafts tapping the basaltic aquifer for irrigation of sugarcane began in the early 1900's. This development of groundwater has been accompanied by an increasing chloride content of water from the basalt, reflecting seawater intrusion as artesian heads declined. Average pumpage for 1958-68 was about 24 mgd (27,000 acre-ft annually); pumpage in both 1972 and 1973 was about 73 mgd (82,000 acre-ft), tripling the former average. At this rate, pumpage exceeds recharge by tens of thousands of acre-feet each year. (Woodard-USGS)  
W76-08054

**RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER BASIN, WEST VIRGINIA,**  
Geological Survey, Morgantown, W. Va.  
E. A. Friel, W. A. Hobba, Jr., and J. L. Chisholm.  
West Virginia Geological and Economic Survey, (Morgantown), Basic Data Report No 3, 1975. 96 p, 3 fig, 10 tab.

**Descriptors:** \*Hydrologic data, \*Potomac River, \*West Virginia, \*Water resources, \*Water quality, River basins, Streamflow, Flow rates, Gaging stations, Basic data collections, Surface waters, Groundwater, Aquifer characteristics, Well data, Drillers logs, Water analysis, Chemical analysis, Pesticides.  
**Identifiers:** \*Potomac River Basin(W Va).

This basic data report was compiled from water-resources studies of the Potomac River basin in West Virginia. Most of the basic data were obtained during the period 1968-1971. The study is a part of the continuing investigation of the water resources of the river basins of West Virginia by the U. S. Geological Survey, conducted in cooperation with the West Virginia Geological and Economic Survey and the West Virginia Department of Natural Resources, Division of Water Resources. Other included data are from the files of the U. S. Geological Survey or from previously published reports. The 10 tables of data include: (1) records of wells and springs, (2) chemical analyses of groundwater, (3) chemical analyses of surface water, (4) field chemical analyses of surface water at stream-gaging stations, (5) low-flow measurements, and field chemical analyses of selected streams and springs, (6) daily specific conductance and discharge of Dillons Run at Capon Bridge, (7) pesticide analyses of groundwater, (8) standard summaries of streamflow data, (9) discharge measurements at partial-record and miscellaneous sites, and (10) selected drillers' logs. (Woodard-USGS)  
W76-08055

**WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1975,**  
Geological Survey, Lawrence, Kans.  
For primary bibliographic entry see Field 7C.  
W76-08057

**GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI,**  
Geological Survey, Baton Rouge, La.

For primary bibliographic entry see Field 2F.  
W76-08061

### 4C. Effects On Water Of Man's Non-Water Activities

**THE PLIGHT OF THE URBAN RESERVOIR: A CASE STUDY,**  
Rutgers - The State Univ., New Brunswick, N. J.  
Water Resources Research Inst.  
For primary bibliographic entry see Field 5C.  
W76-07452

**LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 17-3, LONGSHORE WAVE ENERGY ANALYSES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07470

**PROCEEDINGS: LAKE TAHOE RESEARCH SEMINAR II, 27 SEPTEMBER 1974, SANDS VAGABOND CONVENTION CENTER, SOUTH LAKE TAHOE, CALIFORNIA,**  
Lake Tahoe Area Research Coordination Board South Lake Tahoe, Calif.  
For primary bibliographic entry see Field 5G.  
W76-07793

**CONIFER DAMAGE AND DEATH ASSOCIATED WITH THE USE OF HIGHWAY DE-ICING SALT IN THE LAKE TAHOE BASIN OF CALIFORNIA AND NEVADA,**  
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.  
For primary bibliographic entry see Field 5C.  
W76-07796

**PUBLIC RIGHTS IN GEORGIA'S TIDELANDS,**  
Georgia Univ., Athens. Inst. of Government.  
For primary bibliographic entry see Field 6E.  
W76-07824

**HYDRAULIC EFFECTS OF CHANGES IN BOTTOM-LAND VEGETATION ON THREE MAJOR FLOODS, GILA RIVER IN SOUTHEASTERN ARIZONA,**  
Geological Survey, Sacramento.  
D. E. Burkham.

Available from Supt. of Documents, GPO, Wash., DC 20402, price \$2.05. Professional Paper 655-J, 1976. 14 p, 2 fig, 2 plates, 2 tab, 12 ref.

**Descriptors:** \*Vegetation effects, \*Floods, \*Runoff, \*Arizona, Streamflow, Hydrologic data, Flow rates, Depth, Channel morphology, Peak discharge, Roughness coefficient, Water yield, Evaluation.  
**Identifiers:** \*Gila River(Ariz).

Changes in bottom-land vegetation between December 1965 and October 1972 caused significant differences in stage, mean cross-sectional velocity, mean cross-sectional depth, and boundary roughness at peak discharges of three major floods in an 11.5-mile study reach of the Gila River in southeastern Arizona. The first flood, which had a peak flow of 39,000 cfs, occurred in December 1965 when the dense bottom-land vegetation was dormant. The second flood, which had a peak discharge of 40,000 cfs, occurred in August 1967 when the vegetation had large amounts of foliage; however, the vegetation had been eradicated in the upstream half of the study reach prior to this flood. The third flood, which had a peak discharge of 80,000 cfs, occurred in Oc-

tober 1972; the vegetation had been eradicated in the whole study reach prior to this flood. Compared to the 1965 flood, the large amounts of foliage in the uncleared half of the reach during the 1967 flood apparently caused a 7 percent decrease in mean velocity, a 6 percent increase in mean depth, and an 11 percent increase in the Manning roughness coefficient at peak stage. Compared to the 1965 flood the clearing of the study reach apparently caused a 25 percent increase in mean velocity, a 15 percent decrease in mean depth, and a 30 percent decrease in the Manning roughness coefficient at peak stage in the 1967 and 1972 floods. (Woodard-USGS)  
W76-08050

### 4D. Watershed Protection

**VARIATION IN EVAPORATIVE POWER ON SLOPES OF DIFFERENT EXPOSURE AND STEEPNESS IN THE USSR,**  
For primary bibliographic entry see Field 2D.  
W76-07554

**EXTRACTION AND UTILIZATION OF SPACE ACQUIRED PHYSIOGRAPHIC DATA FOR WATER RESOURCES DEVELOPMENT,**  
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.  
A. Rango, J. Foster, and V. V. Salomonson.  
Available from the National Technical Information Service, Springfield, Va., 22161, as N75 17767, \$4.00 in paper copy, \$2.25 in microfiche. NASA TM X-70827, January 1975. 28 p, 1 fig, 3 tab, 7 ref.

**Descriptors:** Watershed management, \*Remote sensing, \*Satellites(Artificial), \*Watersheds(Basins), \*Drainage area, Physiographic provinces, Drainage patterns(Geologic), Drainage, Geomorphology, Geology, Land use, Drainage density, Runoff, Runoff forecasting, Water resources.  
**Identifiers:** \*ERTS.

ERTS-1 satellite imagery has been evaluated as a means of providing useful watershed physiography information. From these data, physiographic parameters (such as drainage basin area and shape, drainage density, stream length and sinuosity, and the percentage of a watershed occupied by major land use types) were obtained in three study areas: (1) southwestern Wisconsin, (2) eastern Colorado, and (3) portions of the Middle Atlantic States. Using ERTS-1 imagery at 1:250,000 and 1:100,000 scales, it was found that drainage basin area and shape and stream sinuosity were comparable (within 10%) in all study areas to physiographic measurements derived from conventional topographic maps at the same scales. Land use information can be usefully extracted for watersheds as small as 30 sq mi. Improved drainage network and density information was obtained from ERTS-1 imagery in dissected areas such as southwestern Wisconsin, but in heavily vegetated areas (Middle Atlantic States) or areas with little physical relief (Eastern Colorado) low order streams are difficult to detect and the derived drainage densities are significantly smaller than those obtainable from standard maps. It was concluded that ERTS-1 imagery can be employed to advantage in mean annual runoff prediction techniques and in providing or maintaining land use information used in the calibration and operation of watershed models. (Sims-ISWS)  
W76-07566

**ENVIRONMENTAL ASPECTS OF RUN-OFF AND SILTATION IN THE ANACOSTIA BASIN FROM HYPERALTITUDE PHOTOGRAPHS,**  
Maryland Univ., College Park.  
C. D. Ealy, R. F. Mueller, and J. R. Weidner.  
Available from the National Technical Information Service, Springfield, Va., 22161, as N75

## Field 4—WATER QUANTITY MANAGEMENT AND CONTROL

### Group 4D—Watershed Protection

24067, \$3.50 in paper copy, \$2.25 in microfiche. NASA TM X-70888, November 1973. 43 p, 9 fig, 16 tab, 19 ref.

Descriptors: \*Remote sensing, \*Runoff, \*Sifting, Aerial photography, Satellites(Artificial), Environment, Environmental effects, Soils, Water pollution, Urbanization, Construction, Land use, Watersheds(Basins), Drainage, Sedimentation, Erosion, Storms, Geology.  
Identifiers: \*ERTS, \*Anacostia basin.

An analysis has been made of the effects of urbanization and highway construction on run-off, erosion and siltation on the Anacostia watershed. The analysis was based on changes in land use patterns as determined from aerial photographs as well as geologic and hydrologic data for the region. Two selected subwatersheds of Indian Creek and one of Little Paint Branch of the Northeast Branch of the Anacostia were studied in terms of three hypothetical storms of different magnitudes. It was determined that an approximately 10% increase in impervious surface could bring about a 12% increase in the peak discharge for storms of the magnitude of tropical storm Agnes, a 20% increase in peak discharge for 10 hours storm and as much as a 150% increase in peak discharge for a typical thunderstorm. Also the early hourly incremental discharge from a storm of Agnes' magnitude could be increased by as much as 100%. Correspondingly large effects were observed in soil erosion and siltation from bare construction sites which show sediment yields of up to hundreds of thousands of tons per square mile per year. The effects of rapid run-off, erosion and siltation are interrelated with other environmental problems such as sewage, oil and chemical pollution and lack of adequate public transportation. The net result is one of a steady degradation of the urban and suburban environment and of the estuary and bay into which this river flows. (Sims-ISWS)  
W76-07568

**RUNOFF STUDIES ON SMALL WATERSHEDS,**  
West Virginia Univ., Morgantown. Water Research Inst.  
For primary bibliographic entry see Field 2A.  
W76-07673

**APPLICATIONS OF REMOTE SENSING TO WATERSHED MANAGEMENT,**  
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.  
For primary bibliographic entry see Field 4A.  
W76-07791

**ERODIBILITY OF TAHOE SOILS,**  
For primary bibliographic entry see Field 2J.  
W76-07799

**NON-POINT POLLUTION IN THE POTOMAC RIVER BASIN,**  
Interstate Commission on the Potomac River, Bethesda, Md.  
For primary bibliographic entry see Field 5B.  
W76-07820

**WATERSHED PROJECTS.**  
For primary bibliographic entry see Field 6E.  
W76-07866

**ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1975,**  
Geological Survey, Helena, Mont.  
For primary bibliographic entry see Field 2E.  
W76-08049

**FLOOD PEAK ESTIMATES FROM SMALL RURAL WATERSHEDS,**  
Federal Highway Administration, Washington, D.C.

For primary bibliographic entry see Field 2A.  
W76-08077

### 5. WATER QUALITY MANAGEMENT AND PROTECTION

#### 5A. Identification Of Pollutants

**CHESAPEAKE BAY RADIOACTIVE TRACER STUDY,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

For primary bibliographic entry see Field 5B.  
W76-07460

**ENVIRONMENTAL MONITORING THROUGH THE USE OF EXPOSURE PANELS,**  
William F. Clapp Labs., Inc., Dubuxbury, Mass.  
R. E. Hillman.

In: Fisheries and Energy Production: A Symposium, p 55-76, 1975, 5 fig, 6 tab, 33 ref.

Descriptors: \*Monitoring, \*Equipment, Algae, Annelids, Populations, Water quality.  
Identifiers: \*Exposure panels, Millstone Point, New Haven Harbor, Stamford Harbor.

Exposure panels were made of white pine with a transite facing. Monitoring sites in Long Island Sound were at Millstone Point, New Haven Harbor, and Stamford Harbor. Species diversity indexes for algal and annelid populations as they occurred on the panels were calculated for the period from 1968 to 1973. Increases in diversity indexes over time indicated possible changes in water quality. Far more species were found on the Millstone Point panels although the number of phyla found on the panels exposed at all three sites were not significantly different. (See also W76-07487) (Chilton-ORNL)  
W76-07490

**IMPROVED FORMAZAN TEST FOR THE DETERMINATION OF THE DEHYDROGENASE ACTIVITY OF ACTIVATED SLUDGE IN WASTE WATER TREATMENT PLANTS FOR THE JOINT BIOLOGICAL PURIFICATION OF URBAN AND TANNERY-GENERATED WASTE WATERS (VERFEINERTER FORMAZANTEST DER DEHYDROGENASEAKTIVITAET VON BELEBTSCHLAEMMEN IN ANLAGEN ZUR GEMEINSAMEN BIOLOGISCHEN REINIGUNG VON GERBEREIAHWAAESSERN UND STAEDTISCHEN ABWAESSERN),**  
For primary bibliographic entry see Field 5D.  
W76-07518

**TRACE ELEMENTS IN SURFACE WATERS OF THE KARAGANDA OBLAST, (IN RUSSIAN),**  
For primary bibliographic entry see Field 2K.  
W76-07528

**EXTRACTIVE-POLAROGRAPHIC DETERMINATION OF STYRENE AND METHYL-METACRYLATE IN INDUSTRIAL WASTE WATERS (EKSTRAKTSIONNO-POLYAROGRAFICHESKOYE OPREDELENIE STIROLA I METILMETAKRILATA V PRO-MYSHLENNYKH STOCHNYKH VODAKH),**  
O. V. Meshkova, and V. N. Dmitriyeva. Zovodskaya Laboratoriya, Vol. 40, No. 1, p 28-29, 1974.

Descriptors: \*Pollutant identification, \*Chemical wastes, \*Waste water(pollution), Electrodes,

Analytical techniques, \*Polarographic analysis, Separation techniques, Industrial wastes. Identifiers: Styrene, Methylmetacrylate.

A method for the extraction and polarographic determination of styrene and methylmetacrylate in waste waters generated in plastic scintillator production is presented. Extraction was done by means of benzene used in such a quantity that the final ratio of waste water to extract amounted to 1:20. Prior to the polarographic determination, the extract was diluted with 0.05 N-solution of styrene or methylmetacrylate in 95 percent dimethylformamide. Polarographic determination was done in an electric polarograph with a mercury drop electrode against standard solutions. Quantitative determination was performed by means of calibration curve. (Takacs-FIRL)  
W76-07544

**PITTSBURGH RAINWATER ANALYSIS BY PIXE,**  
Pittsburgh Univ., Pa.  
K. C. Chan, B. L. Cohen, J. O. Frohiger, and L. Shabason.  
Tellus, Vol. 28, No. 1, p 25-30, 1976. 5 fig, 2 tab, 13 ref.

Descriptors: \*Rain water, Chemistry of precipitation, \*Heavy metals, Sampling, Water chemistry, Chemical analysis, Water pollution, Air pollution, \*Pollutant identification, Pollutants, Fallout, \*X-ray analysis, X-ray fluorescence, X-ray spectroscopy, X-rays, Analytical techniques, On-site data collections, Meteorology, \*Pennsylvania. Identifiers: \*Pittsburgh(Penn).

Concentrations of thirteen elements in rainwater from the Pittsburgh, Pennsylvania, area were analyzed by Charged Particle Induced X-ray Emission (PIXE). They were compared to rainwater in a rural area and air particulates in Pittsburgh. Local and non-local contributions were discussed. Washout ratios were calculated and found to be larger for smaller size particles, contrary to general belief. This work demonstrated the convenience of using PIXE. (Sims - ISWS)  
W76-07555

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07570

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS,**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07571

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 3 - DES PLAINES RIVER BASIN,**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07572

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07573

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

#### WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS TRIBUTARIES.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0754

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0755

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0756

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA - VOLUME 3, DES PLAINES RIVER BASIN.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0757

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0758

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS ILLINOIS TRIBUTARIES.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-0759

#### ANNUAL WATER-RESOURCES REVIEW, WHITE SANDS MISSILE RANGE, 1975-A BASIC-DATA REPORT,

Geological Survey, Albuquerque, N. Mex.  
For primary bibliographic entry see Field 4B.  
W76-0758

#### AVAILABILITY OF GROUND WATER IN THE PEMIGEWASSET AND WINNIPESAUKEE RIVER BASINS, CENTRAL NEW HAMPSHIRE,

Geological Survey, Concord, N. H.  
For primary bibliographic entry see Field 7C.  
W76-0759

#### REFERENCE GUIDE TO METHODOLOGY FOR THE ANALYSIS OF ORGANIC COMPOUNDS.

Geological Survey, Bay St. Louis, Miss.  
R. A. Baker, and M. L. Yates.

Open-file report, December 1975. 136 p.

Descriptors: \*Pollutant identification, \*Water analysis, \*Organic compounds, \*Methodology, \*Analytical techniques, Sampling, Waste water(pollution), Pesticides, Oil, Phenols, Oxygen demand, Detergents, Physical properties, Chemical properties, Industrial wastes, \*Water quality standards.

Identifiers: \*Water analysis reference guide, Sample preparation, Sample preservation.

This compilation of organic-related analytical techniques was initiated to assist the methods development group of the central laboratories of the U.S. Geological Survey. Details of the procedures are not included. Instead, the compilation summarizes methodology currently employed in research and field studies. Although some methods have been published and standardized, others are unknown beyond the laboratory in which they were developed. The objective is to document these techniques and thus reduce the possibility of repeating developments or of using less effective methods. The literature reference and (or) the individual (laboratory) contact are indicated rather than the analytical detail. The user of this compilation is expected to examine the reference or contact the appropriate individual if the method is unpublished. Hopefully this will facilitate response of the central laboratories to the needs of district (field) personnel. (Woodard-USGS)  
W76-07590

#### RECONNAISSANCE DATA ON LAKES IN WASHINGTON-VOLUME 2. KING AND SNOHOMISH COUNTIES,

Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2H.  
W76-07591

#### RECONNAISSANCE DATA ON LAKES IN WASHINGTON-VOLUME 1. CLALLAM, ISLAND, JEFFERSON, SAN JUAN, SKAGIT, AND WHATCOM COUNTIES,

Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2H.  
W76-07592

#### RECONNAISSANCE OF THE WATER RESOURCES OF THE UPPER KLICKITAT RIVER BASIN, YAKIMA INDIAN RESERVATION, WASHINGTON,

Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 4A.  
W76-07594

#### GEOHYDROLOGY OF THE LAKE AREA AT KATHRYN ABBEY HANNA PARK, JACKSONVILLE, FLORIDA,

Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 2F.  
W76-07602

#### CHEMICAL CHARACTERISTICS OF THE LOWER KISSIMMEE RIVER, FLORIDA-WITH EMPHASIS ON NITROGEN AND PHOSPHORUS,

Geological Survey, Tallahassee, Fla.  
A. G. Lamonds.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-250-938, \$6.00 printed copy; \$2.25 microfiche. Water-Resources Investigations 45-75, November 1975. 133 p, 22 fig, 39 tab, 17 ref.

Descriptors: \*Water quality, \*Florida, \*Surface waters, \*Chemical properties, \*Biological properties, Chemical analysis, Data collections, Nitrogen, Phosphorus, River basins, Impoundments, Stratification, Reservoir releases, Streamflow, Ion transport.  
Identifiers: \*Lower Kissimmee River(Fla).

The impoundments in the lower Kissimmee River in Florida contained calcium bicarbonate water with an average dissolved solids concentration less than 160 mg/l. Concentrations of dissolved solids and phosphorus increased and nitrogen decreased downstream. During warm weather the impoundments were often stratified and water near the bottom often contained very little dissolved oxygen but relatively high concentrations of ammonia nitrogen and phosphorus. During stratifications,

bottom releases from these impoundments often resulted in higher concentrations of ammonia nitrogen and phosphorus below the structures than above them. From July 1971 through June 1972 the Kissimmee River carried 268,000 tons of dissolved solids, including 2,330 tons of nitrogen and 135 tons of phosphorus into Lake Okeechobee. The lower part of the basin (below Lake Kissimmee) contributed about 60 percent of the flow, 49 percent of the nitrogen load, and 86 percent of the phosphorus loads at the most downstream control structure. (Woodard-USGS)  
W76-07603

#### SPRINGS OF PENNSYLVANIA,

Geological Survey, Harrisburg, Pa.  
For primary bibliographic entry see Field 2F.  
W76-07604

#### RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, MAY 1974,

Geological Survey, Denver, Colo.  
W. Thordarson, and W. C. Ballance.  
Contract report USGS-474-226 (Amchitka-45) for U S Energy Research and Development Administration, 1976. 19 p, 3 fig, 3 tab, 9 ref. USERDA Agreement E(29-2)-474.

Descriptors: \*Radiochemical analysis, \*Water analysis, \*Nuclear explosions, \*Underground, \*Alaska, Water pollution sources, Nuclear wastes, Tritium, Baseline studies, Evaluation, Path of pollutants.

Identifiers: \*Amchitka(Alaska).

During May 1974, the U.S. Geological Survey collected water samples from Amchitka Island, Alaska. Tritium determinations were made on 99 water samples, and dissolved gross alpha and gross beta/gamma determinations were made on 34 water samples. No appreciable differences were found between the data obtained in May 1974 and the data obtained before the Cannikin underground nuclear explosion on November 6, 1971. Water samples were collected from wells, streams, lakes, springs, and seeps. Seawater samples were collected both at the shoreline and offshore. (Woodard-USGS)  
W76-07606

#### RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, AUGUST 1974, AND CHEMICAL MONITORING FROM JULY 1972 TO JUNE 1974,

Geological Survey, Denver, Colo.  
W. Thordarson, and W. C. Ballance.  
Contract report USGS-474-225 (Amchitka-44) for U S Energy Research and Development Administration, 1976. 19 p, 3 fig, 3 tab, 10 ref. USERDA Agreement E(29-2)-474.

Descriptors: \*Radiochemical analysis, \*Water analysis, \*Nuclear explosions, \*Underground, \*Alaska, Baseline studies, Water quality, Groundwater, Surface waters, Tritium, Chemical analysis, Water pollution, Evaluation.  
Identifiers: \*Amchitka Island(Alaska).

Radiochemical data from the Amchitka Island, Alaska, study area were obtained from water samples collected by the U.S. Geological Survey during August 1974. Tritium determinations were made on 18 samples, and gross alpha and gross beta/gamma determinations were made on 12 samples. No appreciable differences were found between the data obtained during August 1974 and the data obtained before the Cannikin event (underground nuclear detonation Nov. 6, 1971). Chemical analyses were made on 4 samples collected in 1971, 15 samples in 1972, 11 samples in 1973, and 7 samples in 1974. Comparison of these analyses to analyses of samples collected before the Cannikin event indicates no changes outside of

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

the seasonal range normally found at the sampling locations. (WoodardnUSGS) W76-07607

#### LAKE ERIE, OHIO, PENNSYLVANIA, NEW YORK INTAKE WATER QUALITY SUMMARY 1972.

Environmental Protection Agency, Fairview Park, Ohio.  
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-242 591, \$11.00 in paper copy, \$2.25 in microfiche. December 1973. 403 p. 1 fig., 4 tab.

Descriptors: \*Potable water, \*Lake Erie, \*Water analysis, \*Intakes, Ohio, Pennsylvania, New York, Water properties, Monitoring, \*Data collections, Chemical properties, Physical properties, Bottom sediments, Coliforms, Water temperature, Hydrogen ion concentration, Conductivity, Alkalinity, Turbidity, Color, Odor, Suspended solids, Dissolved solids, Hardness(Water), Chlorides, Sulfates, Ammonia, Nitrogen compounds, Phosphorus compounds, Dissolved oxygen, Biochemical oxygen demand, Chemical oxygen demand, Phenols, Detergents, Silica, Zinc, Copper, Chromium, Iron, Nickel, Cadmium, Lead, Mercury, Arsenic compounds, Manganese, Fluorides, Enteric bacteria, Phytoplankton, Zooplankton, Heavy metals, Toxins.  
Identifiers: Cyanide, Silver, Barium, Selenium, STORET.

Progress made on the cooperative water quality surveillance program between the Ohio Environmental Protection Agency, New York State Department of Environmental Conservation, Pennsylvania Department of Environmental Resources, municipalities, and the EPA at 21 water treatment intakes in Lake Erie during 1972 is detailed. The program is part of a system for monitoring interstate waters by participating state and municipal agencies for water quality standards compliance and supplements federal surveillance efforts of Lake Erie. Water quality information is entered into the STORET data processing system. Water intake physical data and the chemical, physical, and biological characteristics of the sediment in each intake area are described. Water chemical and microbiological data includes temperature, pH, conductivity, alkalinity, turbidity, color, odor total solids, total dissolved (filterable) solids, total suspended (non-filterable) solids, hardness, chlorides, sulfates, cyanide, nitrite nitrogen, nitrate nitrogen, ammonia nitrogen, albuminoid nitrogen, total phosphorus, soluble phosphorus, chlorine demand, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, phenols, methylene blue active substances (anionic detergents), dissolved silica, zinc, silver, copper, hexavalent chromium, chromium, iron, nickel, cadmium, barium, lead, mercury, arsenic, selenium, manganese, fluoride, total and fecal coliforms, total bacteria, and phytoplankton and zooplankton evaluations plus air temperature, wind direction and velocity studies. (Buchanan-Davidson-Wisconsin).  
W76-07610

#### WRC AIDS UNIQUE WATER QUALITY MONITORING PROJECT.

Water Pollution Research Lab., Stevenage (England).  
Water Research Newsheet, February 1976, p. 5. 2 fig.

Descriptors: \*Water quality, \*Monitoring, \*Intakes, Automatic control, Equipment, Design, Europe, \*Pollutant identification, Analytical techniques.  
Identifiers: England.

The schematic of a water quality monitoring station, designed to protect a water intake on the River Wear, England, is illustrated. The system will be installed 2-1/2 miles upstream from the in-

take and will measure dissolved oxygen, temperature, turbidity, ammonia, organic pollutants, and water levels. Via a dual-sensor configuration, one sensor monitors raw water and the other clean water; if the former indicates a value outside present limits the sensors are switched over by means of a novel valve system to provide a check. Readings will be continuously relayed by telemetric links to the water treatment plant for proper action. The system will be supplemented by some form of biological monitoring to provide an alert for toxic substances. (Auen-Wisconsin).  
W76-07613

#### POLLUTANTS 'FINGERPRINTED' BY RADIOACTIVE METHOD.

California Geology, Vol. 26, No. 11, p 276-277, November, 1973. 1 fig.

Descriptors: Waste water treatment, \*Industrial wastes, \*Oil industry, Carbon radioisotopes, Oil wastes, \*Pollutant identification, Analytical techniques, Radioactivity techniques, Radioisotopes, Water pollution sources, \*Organic wastes.  
Identifiers: \*Radioactive fingerprinting.

Radioactive fingerprinting of organic wastes, by separating the major types of carbon compounds, will aid pollution-control agencies with organic-pollution abatement and litigation problems. The radioactive fingerprinting method measures the differences in amounts of radioactive carbon isotopes found in fossil and modern organic pollutants. The fossil fuel waste discharged by petrochemical plants contains no radioactive carbon-14, while the organic wastes from sewage and feedlots will reflect the current atmospheric concentrations of carbon-14. A comparison of the concentrations of carbon-14 in a polluted stream to modern atmospheric concentrations allows the determination of the quantity of organic pollution derived from fossil fuels and the quantity from modern wastes. (Sandoski-FIRL)  
W76-07629

#### NEW OIL POLLUTION DETECTOR.

Water and Waste Treatment, Vol. 16, No. 10, p 16, October, 1973. 1 fig.

Descriptors: Waste water treatment, \*Industrial wastes, Oil industry, \*Oil wastes, \*Pollutant identification, Analytical techniques, Equipment, \*Monitoring, \*Separation techniques, Rivers, Oceans, Oil pollution.

After several years of research by International Combustion of Derby, an oil pollution monitoring system has been developed. The oil pollution detector, Type 4979, is a completely weatherproof instrument which has been designed for the continuous monitoring of oil in industrial effluent, river and sea water. A sampling system has been designed for use with the monitor by Megator Pumps and Compressors Limited. The sampling system skims the surface of the water and passes a sample to the unit. An alarm is activated by the monitor if an abnormal amount of oil is present. Samples can also be obtained by the use of a discharge pipe. A sophisticated oil separation system enables the monitor to separate oil from any other contaminants found in the water. (Sandoski-FIRL)  
W76-07630

#### ACCUMULATION OF MERCURY BY FISH OF THE LITTLE PINEY RIVER AND MILL CREEK.

Missouri Univ., Rolla, Dept. of Chemistry.  
J. O. Stoffer, W. T. Schrenk, and E. T. Lloyd.  
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-252 941, \$4.00 in paper copy, \$2.25 in microfiche. Missouri Water Resources Research Center, Columbia, Completion Report, March 26, 1976. 32 p., 5 fig.

fig. 2 tab, 20 ref. OWRT A-083-MO(1) 14-31-0001-5025.

Descriptors: \*Mercury, Freshwater animals, Fish, \*Absorption, \*Missouri, \*Trout, \*Pollutant identification, Bioassay, Streams, Analytical techniques, Water quality.  
Identifiers: \*Flameless atomic absorption.

A study of mercury accumulation in trout taken from the trout parks and streams of southern Missouri is presented. Mercury in trout is determined by digestion in nitric acid, sulfuric acid, and potassium permanganate, followed by reduction and aeration for measurement by flameless atomic absorption. The mercury accumulation in trout collected and analyzed in this project ranged from 0.1 to 0.3 ppm mercury (microgram mercury/g of tissue). The mercury levels were relatively constant and showed no variation or higher level accumulation with increased size. Levels in the liver were slightly higher than levels in the flesh of the same trout. Previous analysis of trout collected in the mid to late 1950's from the Little Piney River indicated mercury accumulations of approximately 3 ppm. Over the past 25 years, there has been a substantial decrease in mercury found in trout of southern Missouri as a result of cleaner streams.  
W76-07670

#### DETECTION OF TRACE PHOSPHORUS IN NATURAL WATERS BY GRAPHITE OVEN FLAME ANALYSIS.

Georgia Univ., Athens, Dept. of Chemistry.

D. R. Campbell.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 952, \$4.00 in paper copy, \$2.25 in microfiche. Georgia Environmental Resources Center, Atlanta, Report ERC-0276, February 1976, 37 p., 9 fig., 1 tab, 22 ref. OWRT A-061-GA(1) 14-31-0001-5010.

Descriptors: \*Phosphorus, \*Flame photometry, Analysis, Nutrients, \*Pollutant identification, Photometry, Analytical techniques, Chemical analysis, Methodology, Trace elements, Water analysis, Instrumentation.  
Identifiers: Graphite furnace.

Phosphorus is analyzed by coupling a graphite furnace to a flame photometer. A sample is added to the furnace where it is dried and vaporized at temperatures which can be as high as 2800 C. The sample is swept out of the furnace by nitrogen mixed with air, and drawn into a hydrogen-air flame. In the flame, POH emission is observed and integrated. The emission is subject to interference from calcium and ferric iron; however, by adding a 'constant matrix' of calcium and EDTA to both samples and standards, it was possible to determine total phosphorus in sewage samples. This method has a detection limit of 3 micrograms/g/liter phosphorus. The relative standard deviation on repeat measurements of a solution containing 1 mg/liter phosphorus was between 2 and 3%. An analysis, including sample pretreatment, requires less than two minutes. The instrumentation can be used in mobile laboratories for field analyses. Because of its greater sensitivity and reduced time requirement, this method is a superior alternative to present methods for phosphorus. It will be very useful in rapidly screening water samples for high levels of phosphorus.  
W76-07672

#### HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME III.

Ontario Inst. for Environmental Studies, Toronto.  
J. C. Van Loon.  
Research Report No. 30, Training and Technology Transfer Division (Water), Environmental Protection Services, Environment Canada, Ottawa, Canada, 37 p., 2 fig., 10 tab, 22 ref., (1976). 72-5-3.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

Descriptors: \*Heavy metals, \*Sewage, \*Sludge, Agriculture, \*Lands, Metals, \*Sewage sludge, Analysis, Absorption, Mercury, Molybdenum, Gas chromatography, Canada, Chemical analysis, \*Pollutant identification.

Identifiers: Electro-chemical techniques, Arsenic, Selenium, Tin, Thermal volatility, Ontario, Sludge analysis.

Existing and newly developed methods for the analysis of metals in sewage sludges are described. Atomic absorption and electro-chemical techniques are emphasized. Procedures developed specifically for arsenic, selenium, mercury, tin and molybdenum analyses are included. The quartz 'T' tube furnace for flameless atomic absorption studies of thermal volatility and gas chromatography of metal compounds in sludge has been developed and is described. A number of chemical sewage sludges were analysed for metals and the results are tabulated. (Environment Canada) W76-07767

**SURVEILLANCE METHODOLOGY - 1974,** Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. T. J. Carew, and D. J. Williams.

Technical Bulletin No. 92, 1975, 28 p., 15 fig., 6 ref., append.

Descriptors: \*Lake Ontario, \*Water quality, \*Surveys, \*Methodology, Temperature, Colour, Instrumentation, Water properties, Water analysis, International Joint Commission, \*Pollutant identification.

Identifiers: Shipboard procedures.

In 1974, a pilot surveillance program was implemented on Lake Ontario to meet the requirements of the International Joint Commission for information on areas of improving or deteriorating water quality, general lake-wide conditions and response to the impact of management procedures. This report entails documentation and discussion of parameters, analytical methodology and shipboard procedures. (Environment Canada) W76-07769

**ORGANOCHLORINE PESTICIDE RESIDUES IN CULTURED FISHES OF TAIWAN,** Academia Sinica, Taipei (Taiwan). Inst. of Zoology.

For primary bibliographic entry see Field 5C.

W76-07697

**HIGH-SPEED LIQUID CHROMATOGRAPHIC CLEANUP OF ENVIRONMENTAL SAMPLES PRIOR TO THE GAS CHROMATOGRAPHIC DETERMINATION OF LINDANE,** Canada Centre for Inland Waters, Burlington (Ontario).

R. H. Larose.

J Assoc Off Anal Chem. 57(5), p 1046-1049, 1974.

Descriptors: Sampling, \*Environment, \*Cleaning, \*Chromatography, \*Gas chromatography, \*Pollutant identification.

Identifiers: \*Lindane, Liquid chromatography.

A method is described which permits the removal of interfering co-extractives from lindane, using high-speed liquid chromatography. Fractions are collected from the liquid chromatograph for further analysis by gas-liquid chromatography. The cleanup procedure takes less than 5 min and recoveries of more than 90% are obtained. The detection limit for water samples is 5 ng/L. Copyright 1974, Biological Abstracts, Inc.

W76-07701

**DETERMINATION OF ZINC AND CADMIUM IN ENVIRONMENTALLY BASED SAMPLES BY**

**THE RADIOFREQUENCY SPECTROMETRIC SOURCE,** Oak Ridge National Lab., Tenn. Y. Talmi. Anal Chem. 46(8), p 1005-1010, 1974.

Descriptors: \*Cadmium, \*Zinc, \*Sampling, Trace elements, Spectroscopy, Environment, Analysis, \*Analytical techniques, Coal, Flyash, Gasoline, Soil, Cattle, Leaves, Fish, Gonads, \*Pollutant identification.

Identifiers: \*Radiofrequency furnace spectrometry, Bunker oil, Liver.

The applicability of the radiofrequency furnace (RFF) spectrometric source to the analysis of trace amounts of Cd and Zn in environmental samples is described. Modifications in the original design of the system were employed to enhance sensitivity and reduce interferences. Both atomic absorption (AA) and atomic emission (AE) spectrometric modes were successfully used with samples pretreated by various methods such as wet ashing, on-substrate wet ashing and Solvane solubility, and by direct analysis. Samples analyzed include coal, fly ash, bunker oil, gasoline, soil, bovine liver, orchard leaves and fish gonad. The samples, once prepared, were analyzed at the rate of 5 per minute with an average overall accuracy of 6.8% and reproducibility of 5.5%. Detection limits for Cd and Zn were 5 pg with the AA mode and 6 and 8 pg, respectively, with the ZE mode. Relative sensitivities are in the 0.001-0.5 ppm range. Interferences in the 2 operating modes are compared. Copyright 1974, Biological Abstracts, Inc. W76-07702

**ANALYSIS OF THE POLYCHLORINATED BIPHENYL PROBLEM, APPLICATION OF GAS CHROMATOGRAPHY-MASS SPECTROMETRY WITH COMPUTER CONTROLLED REPETITIVE DATA ACQUISITION FROM SELECTED SPECIFIC IONS,** National Environmental Research Center, Cincinnati, Ohio. Analytical Quality Control Lab. J. W. Eichelberger, L. E. Harris, and W. L. Budde. Analytical Chemistry, Vol. 46, No. 2, p 227-232, February, 1974. 6 fig, 3 tab.

Descriptors: \*Gas chromatography, \*Mass spectrometry, \*analytical techniques, Computers, Ions, Monitoring, Pesticides, \*Pollutant identification, Water pollution sources, Lakes, \*Polychlorinated biphenyls.

An application of gas chromatography-mass spectrometry with computer controlled repetitive data acquisition from selected specific ions was used for polychlorinated biphenyl (PCB) analysis. The application of subset data acquisition techniques were examined for the possibility of a procedure which is sufficiently sensitive, but which eliminates the need for elaborate separations, and does not sacrifice too much of the qualitative information content inherent in a complete mass spectrum. Several sets of candidate masses were evaluated using PCB's mixed with certain pesticides which are likely to be in a solvent extract of an environmental sample. The method has also been tested with a contaminated sediment sample from an Ohio lake and appears useful for both qualitative and quantitative analyses. (Sandoski-FIRL) W76-07709

**FLUORESCENT WHITENING AGENTS: ACUTE FISH TOXICITY AND ACCUMULATION STUDIES,** Procter and Gamble Co., Cincinnati, Ohio. Environmental Water Quality Research Dept. For primary bibliographic entry see Field 5C. W76-07713

**DECHLORINATION OF MUNICIPAL SEWAGE USING SULFUR DIOXIDE,** International Pacific Salmon Fisheries Commission, New Westminster (British Columbia). For primary bibliographic entry see Field 5C. W76-07715

**METHOD FOR ASSESSMENT OF TOXICITY OR EFFICACY OF MIXTURES OF CHEMICALS,** Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab. For primary bibliographic entry see Field 5C. W76-07718

**SATELLITES HELPING TO SOLVE DOWN-TO-EARTH CIVIL ENGINEERING PROBLEMS.** For primary bibliographic entry see Field 7B. W76-07737

**WATER DATA COLLECTION AND USE,** Department of the Environment, London (England). Water Data Unit. For primary bibliographic entry see Field 7C. W76-07785

**AIR QUALITY IN THE LAKE TAHOE BASIN,** California Univ., Davis. Inst. of Ecology; and California Univ., Davis. Dept. of Physics. T. A. Cahill.

In: Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sands Vagabond Convention Center, South Lake Tahoe, California. Report No. NSF/RA/G-74-012, p 63-68. 1 ref.

Descriptors: \*Air pollution, \*Aerosols, Sulfur, Haze, Pollutants, Mountains, Lakes, Fuels, Fossil fuels.

Identifiers: \*Lake Tahoe(Nev-Calif), \*Air pollution sources, Visibility.

Lake Tahoe is over twenty miles long, yet we expect to see the mountains on the far side—an important part of the scenic value. Thus, a significant part of the recreational value of the lake is based upon visibility greater than thirty miles most of the time. The problem of area-wide degradation of visibility is one which is vital to Lake Tahoe's future. Other sites in California show that fine sulfur particulates are likely to be responsible for the hazes presently seen at Lake Tahoe on many summer days. There are four sources of fine sulfur aerosols that could cause problems: (1) fuel oil combustion in the basin; (2) the conversion of residual sulfur in gasoline into fine sulfur particulates, an unfortunate byproduct of the EPA mandated catalytic converters on new cars sold in California; (3) the landing-take off cycle of a Boeing 727, which produces as much sulfur oxides as about 500 cars driving from Meyers to Stateline; and (4) transport of fine sulfur particulates present in the Sacramento valley or Reno area into the basin. (See also W76-07793) (Sims-ISWS) W76-07797

**POLLUTION: CONCEPT AND DEFINITION,** Australian National Univ., Canberra. Dept. of Forestry. For primary bibliographic entry see Field 5G. W76-07795

**ORGANIC SUBSTANCES IN POTABLE WATER AND IN ITS PRECURSOR: II. APPLICATIONS IN THE AREA OF ZURICH,** Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland); and Eidgenoessische Technische Hochschule, Zurich (Switzerland). Gas Chromatography Lab. K. Grob, and G. Grob. J Chromatogr. 90(2), p 303-313, 1974.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

Descriptors: \*Potable water, \*Organic wastes, Europe, Sampling, \*Analytical techniques, Lakes, \*Water pollution sources, \*Pollutant identification.

Identifiers: Closed-loop air stream, Lake Zurich, Switzerland, Zurich.

The method of transferring organic substances from water at room temperature on to an adsorbent filter by a closed-loop air stream was applied to various water samples. These include water from Lake Zurich (Switzerland) taken at different depths and under different weather conditions, as well as relatively pure samples of spring, ground and tap water. In a sample of accidentally contaminated water the degree and the (unexpected) source of contamination were determined, neither of which could be done by commonly used methods. The characteristics and origin of various water pollutants and concentrations of selected pollutants are given. (See also W75-08556)—Copyright 1974, Biological Abstracts, Inc.

W76-07956

#### THE DISTRIBUTION OF STIGEOCLONIUM TENUIS KUTZ. IN SOUTH WALES IN RELATION TO ITS USE AS AN INDICATOR OF ORGANIC POLLUTION,

University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.

For primary bibliographic entry see Field 5B.  
W76-07957

#### THE PRESERVATION AND STORAGE OF URINE SAMPLES FOR THE DETERMINATION OF MERCURY,

Los Alamos Scientific Lab., N. Mex. Health Div.; and Los Alamos Scientific Lab., N. Mex. Bio-Analysis and Chemical Section.

P. Trujillo, P. Stein, and E. Campbell.  
Am Ind Hyg Assoc J. 35(5), p 257-261, 1974.

Descriptors: Analytical techniques, \*Mercury, \*Sampling, \*Urine, Preservation, \*Pollutant identification.

Identifiers: Containers, Glass containers, Paper containers, Plastic containers.

The use of various preservatives and storage containers for the sampling of (human) urine and water samples for Hg analysis was evaluated. Glass storage containers were preferred over paper or plastic containers. Potassium persulfate, when added to the sample at the time of collection preserved the sample for several days without significant losses. Potassium permanganate was unacceptable for preserving Hg in aqueous solution because of the formation of insoluble manganese dioxide.—Copyright 1974, Biological Abstracts, Inc.

W76-07959

#### INCREASE OF THE EFFECTIVENESS OF DIRECT DETECTION OF VIRUSES IN SURFACE WATERS BY ULTRAFILTRATION THROUGH SOLUBLE ULTRAFILTERS, (IN RUSSIAN),

Nauchno-Issledovatel'skii Institut Gigienny, Moscow (USSR).

Z. S. Nikolaevskaya, and M. S. Aizen.

Gig Sanit. 4, p 68-70, 1974.

Descriptors: \*Pollutant identification, \*Viruses, Surface waters, Filters, Filtration, Methodology, Analytical techniques.

Identifiers: Picornavirus, Poliovirus,

\*Ultrafiltration.

A number of methods for purifying and concentrating viruses (type I poliovirus, Mahoney strain) in surface waters were studied under experimental and natural conditions. The data indicated the high sensitivity of the method of ultrafiltration through soluble lanthanum aluminum alginate ultrafilters in comparison with gauze pads. The manufacture of

the soluble ultrafilters is described.—Copyright 1975, Biological Abstracts, Inc.

W76-07960

#### ISOTOPIC RATIOS OF RADIORUTHENIUM AND RADIOCERIUM IN RAIN WATER AT OSAKA IN RELATION TO NUCLEAR EXPLOSIONS DURING THE PERIOD OF LATE 1969 TO 1972,

Radiation Center of Osaka Prefecture, Osaka (Japan). Dept. of Physical Instrument.

T. Matsunami, A. Mizohata, and T. Mamuro.

J Radiat Res. 15(2), p 96-102, 1974.

Descriptors: \*Rain, \*Radioactivity, \*Nuclear wastes, Radioisotopes, Isotope studies, Pollutant identification.

Identifiers: \*Cerium; \*Explosions, Osaka, \*Ruthenium, Stratosphere, Strontium, Troposphere, \*Japan.

The isotopic activity ratios of  $^{103}\text{Ru}$  to  $^{106}\text{Ru}$  and  $^{141}\text{Ce}$  to  $^{144}\text{Ce}$  in rain water were studied during the period of late 1969–Aug. 1972. The ratios demonstrated many peaks during the observation period, each of which probably resulted from settlement of stratospheric or tropospheric nuclear debris produced by nuclear explosions during the same period. A method of distinguishing fresh nuclear debris from old debris on the basis of measured radiostrontium activity ratios was applied to estimate the contributions of the  $^{106}\text{Ru}$  and  $^{144}\text{Ce}$  produced by a new explosion to the total deposition of these nuclides from the measured activity ratios of  $^{103}\text{Ru}$  to  $^{106}\text{Ru}$  and  $^{141}\text{Ce}$  to  $^{144}\text{Ce}$ . The contributions thus estimated ranged from zero to nearly 100%, depending on various factors.

W76-07961

#### 210PO RADIOACTIVITY IN ORGANS OF SELECTED TUNAS AND OTHER MARINE FISH,

Scripps Institution of Oceanography, La Jolla, Calif. Soledad Marine Radioactivity Lab.

For primary bibliographic entry see Field 5C.

W76-07962

#### MEASUREMENTS OF PHYTOL IN ESTUARINE SUSPENDED ORGANIC MATTER,

Naval Research Lab., Washington, D.C.

D. M. Schultz, and J. G. Quinn.

Mar Biol (Berl.) 27(2), p 143-146, 1974.

Descriptors: \*Preserved solids, Organic wastes, \*Chlorophyll, Analytical techniques, \*Gas chromatography, Chromatography, \*Rhode Island, \*Bays, \*Estuarine environments, \*Pollutant identification, Measurement, Spectrophotometry. Identifiers: \*Phytol, Narragansett Bay(RI), Isoprenol alcohol phytol.

The unsaturated isoprenol alcohol phytol is a constituent of the major chlorophyll species a and b and, as such, should be useful as an estimator for chlorophyll values. A method for the extraction of phytol from estuarine suspended organic matter and analysis by gas-liquid chromatography (GLC) is described. Comparisons of the GLC method for phytol/chlorophyll analyses and a spectrophotometric chlorophyll method indicate that the GLC method gives values in good agreement with the spectrophotometric procedure. Similar trends in suspended chlorophyll values were observed in Narragansett Bay (Rhode Island) water samples using the GLC method and a fluorometric procedure. The results of these studies indicate that the GLC method provides reliable analyses of chlorophyll and, although more time-consuming, has the advantage that other organic species can be analyzed in the same sample.—Copyright 1975, Biological Abstracts, Inc.

W76-07974

#### HEAVY METALS AS TRACE CONSTITUENTS IN NATURAL GROUNDWATERS AND POLLUTED,

Kiel Univ. (West Germany). Geologisch-Palaontologisches Institut und Museum.

G. Matthes.

Geol Mijnbouw. 53(4), p 149-156, 1974.

Descriptors: Metals, Effects, Toxicity, \*Public health, Groundwater, \*Pollutant identification, \*Heavy metals.

Identifiers: Geochemical, Physiological effects.

The natural and man-made concentrations of heavy metals are discussed in terms of their abundance, geochemical mobility, and physiological effects on man. The many gaps of geochemical information about heavy elements in the ground should be filled, especially for those elements which are important to human health.—Copyright 1975, Biological Abstracts, Inc.

W76-07978

#### PREPARATION OF ALGAE FOR THE GAS CHROMATOGRAPHIC DETERMINATION OF LINDANE, (IN GERMAN),

Hamburg Univ. (West Germany). Institut fuer Hydrobiologie und Fischereiwissenschaft.

R. Diercking, and P.-D. Hansen.

Ber Dtsch Wiss Komm Meeresforsch. 23(3), p 326-329, 1974.

Descriptors: Algae, \*Lindane, Hydrocarbons, \*Cultures, Analytical techniques, Environment, Toxicology, Pollutants, \*Pollutant identification, \*Gas chromatography chlorinated hydrocarbon pesticides.

Identifiers: \*Chlorella, \*Dunaliella, Environmental toxicology, \*Tests.

In connection with accumulation tests for the chlorinated hydrocarbon lindane in cultures of Dunaliella and Chlorella a method was developed to prepare the algae. A special filter preparation method resulted in a high recovery rate. (This study is relevant to environmental toxicology).—Copyright 1975, Biological Abstracts, Inc.

W76-07979

#### THE MERCURY CONTENTS OF FISH FROM CARINTHIAN LAKES, (IN GERMAN),

Bundesanstalt fuer Virusseuchenbekämpfung der Haustiere, Vienna (Austria).

For primary bibliographic entry see Field 5C.

W76-07981

#### MERCURY IN SOME MARINE ORGANISMS FROM THE OSLOFJORD,

Oslo Univ. (Norway). Dept. of Marine Zoology.

For primary bibliographic entry see Field 5C.

W76-07982

#### THE PRESENT CONDITION OF WATER POLLUTION AND THE FUTURE PROBLEMS (SUISHITSU ODAKU NO GENJO TO KONGO NO MONDAITAI),

Japan Environmental Agency, Tokyo.

K. Hoashi.

Kankyo Gijutsu, (Environmental Conservation Engineering) Vol. 2, No. 1, p 14-21, January, 1973. 3 tab.

Descriptors: \*Water quality, \*Water pollution, Investigations, \*Toxicity, Sampling, Standards, Cadmium, Lead, Mercury, Phosphorus, Chromium, Biochemical oxygen demand, Chemical oxygen demand, Pollutant identification.

Identifiers: Japan, Cyanogen, Arsenic, Coli bacillus.

A 1971 investigation of Japan's public water quality resulted in the following published information. Samples for the examination of toxic matter were collected at 1966 locations, and those for living

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Identification Of Pollutants—Group 5A

standards were collected at 1253 locations including 330 rivers, 9 lakes, and 68 sea locations. Toxicity was analyzed in 89,074 test samples with 0.6 percent failure to pass the acceptable quality standard; in 1970, the failure percentage was 1.4. As in 1970, cyanogen (1.2%), cadmium (0.7%), and lead (1.4%) were the elements that had highest failure rates. Other major toxic substances were alkyl mercury, organic phosphorus, chromium, arsenic, and total mercury. In the examination of environmental standards, 22.6 percent of the 76,757 samples failed to meet the requirements. For rivers, 30 to 70 percent failed to meet the standard BOD level and 50 to 70 percent of the samples failed to pass the standard for presence of *Escherichia coli*. 43.9 percent failed to pass the standard for lakes and ponds. Of the 15,960 sea water samples, 17.8 percent failed to meet the COD standard. (Seigle-FIRL)  
W76-08007

#### **EFFICIENCY OF HEAVY METALS REMOVAL IN MUNICIPAL SEWAGE TREATMENT PLANTS,**

Environmental Protection Agency, Kansas City, Mo.

For primary bibliographic entry see Field 5D.

W76-08008

#### **ULTRASONICS IN THE SEWAGE INDUSTRY,**

Municipality of Metropolitan Seattle, Wash.

For primary bibliographic entry see Field 5D.

W76-08018

#### **OXYGEN MEASUREMENT IN ACTIVATION BASINS WITH THE ZUELLIG-02-PROBE,**

K. Scherb, and H. Bauer.

Wasser- und Abwasser-Forschung, Vol. 6, No. 3, p 93-94, 1973. 2 fig.

Descriptors: \*Measurement, \*Instrumentation, \*Oxygen, \*Activated sludge, Electrolytes, Analytical techniques, \*Pollutant identification.

Identifiers: Oxygen sensors, Activation basins, \*Zuellig oxygen probe.

Encouraging results have been gained during a three-month operation in an activated sludge basin using a Zuellig type oxygen sensor. The device, especially suited for long-term measurement of the oxygen content in activation basins, is operated according to the Toedt principle, providing polarization current between two different noble metals in an electrolyte solution. The magnitude of the polarization current is determined by the oxygen content of the medium. The probe is composed of a plastic tube with two metal rings (electrodes) at its lower extremity, which are continuously cleaned by a rotating grindstone. The probe is splash-proof, non-corrosive, and permits nearly maintenance-free, long-term measurements even under rough working conditions. (Tacke-FIRL)  
W76-08019

#### **APPLICATION OF THE STANTON SYRINGE METHOD TO THE ANALYSIS OF MERCURY IN NATURAL WATERS,**

Fisheries and Marine Service, West Vancouver (British Columbia). Pacific Environment Inst.

J. A. J. Thompson, and F. T. McComas. Environmental Letters, Vol. 5, No. 3, p 189-197, 1973. 1 fig, 1 tab, 12 ref.

Descriptors: Analytical techniques, \*Mercury, \*Water analysis, \*Spectrophotometry, Measurement, \*Pollutant identification, Separation techniques.

Identifiers: \*Atomic absorption spectrophotometry.

A relatively inexpensive, simple, and precise method for the analysis of subnanogram quantities of mercury in natural waters involving the use of

wet chemical procedures to preconcentrate the mercury and a 'semi-micro' method of analysis based on atomic absorption spectrophotometry is described. Through a combination of a solvent extraction procedure and a 'cold-vapor' technique, standard deviations of plus or minus 0.0112 can be obtained at the mean concentrations of 0.023 and 0.166 ng/ml, respectively. Recoveries of 94 percent are reported. (Sandoski-FIRL)  
W76-08025

#### **AN IMPROVED METHOD FOR THE ISOLATION OF PHENOLS FROM WATER,**

Washington and Jefferson Coll., Pa. Dept. of Chemistry.

J. A. Vinson, G. A. Burke, B. L. Hager, D. R. Casper, and W. A. Nylander. Environmental Letters, Vol. 5, No. 3, p 199-207, 1973. 2 tab, 6 ref.

Descriptors: \*Analytical techniques, \*Phenols, \*Water analysis, Colorimetry, Sampling, Adsorption, \*Pollutant identification, Separation techniques, \*Methodology.

Identifiers: Aminoantipyrine.

systems, Rainfall, Path of pollutants, Pollutant identification.

Identifiers: Devon River Authority, Telephone system, River level.

A low-cost data transmission system developed in conjunction with the Devon River Authority, which uses the public telephone network to provide continuous monitoring of river pollution and/or give early flood warnings, has been developed by Delta Controls Ltd., of Kingston-on-Thames. Known as the Deltrol TeleGen systems, the solid-state equipment can be used to monitor rainfall and river levels at each of the remote stations to be monitored. Each channel in use is dedicated to a function and scanned and transmitted in order. If a reading needs to be double-checked, it is only necessary to replace the receiver and dial the number again. The memory is not reset if interrogated by accident and because it is continually up-dated, the risk of outside interference is eliminated. Apart from the initial cost of the equipment, the only other expenditure required is a low rental charge for a telephone at the stations. (Sandoski-FIRL)  
W76-08028

#### **GEOLOGY AND GROUND-WATER RESOURCES OF HETTINGER AND STARK COUNTIES, NORTH DAKOTA,**

Geological Survey, Bismarck, N. Dak.

For primary bibliographic entry see Field 4B.

W76-08043

#### **QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PARTS 9 AND 10. COLORADO RIVER BASIN AND THE GREAT BASIN.**

Geological Survey, Reston, Va.

For primary bibliographic entry see Field 7C.

W76-08045

#### **WATER RESOURCES DATA FOR COLORADO, 1974: PART 2. WATER QUALITY RECORDS,**

Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 7C.

W76-08047

#### **GEOHYDROLOGIC RECONNAISSANCE OF THE IMPERIAL VALLEY, CALIFORNIA,**

Geological Survey, Reston, Va.

For primary bibliographic entry see Field 4B.

W76-08052

#### **RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER BASIN, WEST VIRGINIA,**

Geological Survey, Morgantown, W. Va.

For primary bibliographic entry see Field 4B.

W76-08055

#### **SURFACE-WATER RESOURCES OF THE TANIGAHOA, TCHEFUNCTA, AND NATALBA RIVER BASINS, SOUTHEASTERN LOUISIANA,**

Geological Survey, Baton Rouge, La.

For primary bibliographic entry see Field 4A.

W76-08056

#### **WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1975,**

Geological Survey, Lawrence, Kans.

For primary bibliographic entry see Field 7C.

W76-08057

#### **SOLUTE TRANSPORT AND MODELING OF WATER QUALITY IN A SMALL STREAM,**

Geological Survey, Menlo Park, Calif.

For primary bibliographic entry see Field 5B.

W76-08058

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5A—Identification Of Pollutants

**GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI,**  
Geological Survey, Baton Rouge, La.  
For primary bibliographic entry see Field 2F.  
W76-08061

**MIX2: A COMPUTER PROGRAM FOR MODELING CHEMICAL REACTIONS IN NATURAL WATERS,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W76-08062

**ACCUMULATION AND LOSS OF RESIDUES OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) IN FISH MUSCLE TISSUE: LABORATORY STUDIES,**  
Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeast Fish Control Lab.  
For primary bibliographic entry see Field 5C.  
W76-08065

### 5B. Sources Of Pollution

**EVALUATION OF A SOIL NITRATE TRANSPORT MODEL,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca. Dept. of Agricultural Economics.  
M. F. Walter, T. S. Steenhuis, G. D. Bubenzier, and J. C. Converse.  
Presented at 1974 Winter Meeting of the American Society of Agricultural Engineers, December 10-13, 1974. Chicago, Illinois 5 fig, 8 tab, 10 ref. OWRT-B-076-WIS(5).

Descriptors: \*Model studies, \*Nitrates, \*Soil water movement, Groundwater, Pollutants, Leaching, \*Farm wastes, Groundwater movement, \*Water pollution sources, Dairy industry, Liquid wastes, Coarse sediments, Sands, Silts.

The potential for groundwater pollution from heavy land applications of dairy manure is a growing concern because manure is being concentrated in smaller areas. The worst conditions in terms of nitrate leaching to the groundwater occur on coarse textured soils in early spring. A computer model was developed specifically for heavy spring application of liquid dairy manure on coarse soils. The model was used to predict nitrate movement from the application of manure on experimental plots on a Plainfield sand and in a Plano silt loam soil column. The computer model was designed to estimate, for specified intervals of soil depth and time after manure application, the delay to initial nitrification of manurial ammonium, ammonium nitrification rate, soil organic nitrogen mineralization rate, nitrate dispersion, nitrate and ammonium content and soil moisture. Precipitation and temperature data, date of manure application, ammonium concentration of liquid manure, and quantity of manure applied must be specified for each particular case. When the model properly simulates nitrate movement through a soil, the results are no better than the input weather data. The model depends on interrelationship between temperature and effective precipitation over a period of several weeks or months. Input weather data should be based on the probability of a sequence of particular weather conditions occurring. (Skogerboe—Colorado State)  
W76-07453

**CHESAPEAKE BAY RADIOACTIVE TRACER STUDY,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
A. R. Tool.  
Miscellaneous Paper H-76-1, January 1976. 34 p., 4 fig, 1 tab, 9 pl, 15 ref, append.

Descriptors: \*Chesapeake Bay, \*Radioactivity techniques, \*Tracers, \*Path of pollutants, Tides, Bays, Waste disposal, \*Maryland, Pollutant identification.  
Identifiers: \*Dredged material, \*Tidal currents, Poole Island(Md).

A radioactive tracer study was conducted in the Chesapeake Bay near the Poole Island Deep disposal area to obtain qualitative information concerning movement of dredged material placed in the area. Approximately 15 curies of gold(198) was mixed with a sediment sample and placed on the bottom of the Bay. Daily tracings of the labeled sediment revealed movement along a narrow band in the general direction of the tidal currents. Movement in the direction of flood flow was determined to be much greater than that in the direction of ebb flow. (WES)  
W76-07460

**A STUDY OF THE FAUNA IN DREDGED CANALS OF COASTAL LOUISIANA,**  
Louisiana Wildlife and Fisheries Commission, New Orleans.  
For primary bibliographic entry see Field 5C.  
W76-07486

**FACTORS AFFECTING WATER QUALITY FROM STRIP-MINED SITES,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agricultural Engineering; and Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.  
J. F. Connell, D. N. Contractor, and V. O. Shanoltz.

Virginia Water Resources Research Center, Blacksburg, VWRRRC Bulletin 87, March 1976, 75 p. 18 tab, 18 fig, 19 ref.

Descriptors: Water quality, \*Mine drainage, Strip-mines, Watershed management, Model studies, Linear programming, Oxidation, Forecasting, \*West Virginia, \*Path of pollutants, Drainage.  
Identifiers: \*Strip-mine drainage, Mine runoff, Pyrite oxidation.

This project analyzed the parameters that influence the quality of water from stripmined sites. An instrumented watershed near Beckley, W. Va. provided data on precipitation, stream flow, and water quality, both before and during mining operations. The data were analyzed to derive linear relationships between a water-quality parameter and such variables as temperature, current and antecedent precipitation, and the extent of the area disturbed by mining. Mathematical formulae representing sulfate and calcium concentration, alkalinity, turbidity, conductance, and discharge were used in the study. A correlation analysis also was made among the various water-quality parameters. A formula in each water-quality parameter was derived for each of three conditions: (1) before mining; (2) during mining for the disturbed area alone, and (3) during mining for the entire watershed. The coefficients in the formulae were refined for minimum error. The coefficients indicate that temperature is not an important water-quality consideration except in the case of alkalinity. The coefficients of the antecedent precipitation terms indicate that, in most cases, surface runoff is the basic mechanism by which the substances affecting water quality are conveyed from the disturbed area into a receiving stream. The findings provide data that can be used in the future for predicting water-quality impacts from strip-mining operations at particular sites in the study area.  
W76-07582

**QUALITY AND QUANTITY OF NONPOINT POLLUTION SOURCES IN RURAL SURFACE WATER RUNOFF ON OAHU, HAWAII,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
S. K. Yim, and G. L. Dugan.

Available from the National Technical Information Service, Springfield, Va 22161, as PB- 252 765, \$4.50 in paper copy, \$2.25 in microfiche. Technical Report No. 93, June 1975. 60 p, 17 fig, 15 tab, 42 ref. OWRT A-044-HI (1) 14-31-0001-5011.

Descriptors: \*Eutrophication, \*Nutrients, \*Rural areas, \*Sediment, Water quality, Surface runoff, Nitrogen, Phosphorus, \*Hawaii, Water pollution sources, Agricultural runoff, Sampling, Chemical oxygen demand, Storm runoff.  
Identifiers: Tipping bucket, Forest runoff, \*Nonpoint pollution sources.

The quality and quantity of rural runoff was the subject of a field study conducted on the island of Oahu. The study investigated surface water runoff from three rural land uses: an undeveloped forested area, a sugarcane field, and a pineapple field. A 37.85-l (10-gal) tipping bucket sampler was used to collect composited runoff samples at each site and to record the volume of runoff associated with each sample. The results show that storm water runoff from undeveloped areas is the major contributor of nutrient, COD, and sediment, into wet weather streamflow. Furthermore, nutrients and COD in this type of runoff are primarily in sediment-associated forms. The sugarcane field samples included storm runoff and irrigation tailwater. Cane field runoff in central Kunia was lower in most water quality parameters than the forest runoff in Manoa. Insufficient samples due to dry weather prohibited a thorough analysis of pineapple field runoff.  
W76-07583

**EFFECTS OF CAGE CULTURE OF CATFISH UPON WATER QUALITY IN RESERVOIRS,**  
Clemson Univ., S. C. Dept. of Entomology.  
H. A. Loyacano, Jr., and A. M. Burch.  
Available from the National Technical Information Service, Springfield, Va 22161, as PB-252 766, \$3.50 paper copy, \$2.25 in microfiche. South Carolina Water Resources Research Institute, Clemson. (1976) Report 61, 12 p, 2 tab, 18 ref. OWRT B-033-SC (1)

Descriptors: \*Water quality, \*Aquaculture, \*South Carolina, Catfishes, Reservoir, Lakes, \*Monitoring, Water pollution sources, Water pollution effects.  
Identifiers: \*Catfish cage culture, Thermal effluents, Lake Keowee(SC), Lake Hartwell(SC).

Water quality was monitored in Lakes Keowee and Hartwell, South Carolina, at sites proximal to cages and at control sites before, during, and after periods when catfish were fed in the cages. Parameters measured were alkalinity, carbon dioxide, dissolved oxygen, nitrate nitrogen, orthophosphate, temperature, and turbidity in both lakes; total phosphate, total hardness, and ammonia nitrogen in Lake Hartwell only; and Secchi-disk transparency in Lake Keowee only. Water quality was not significantly different between cage and control sites.  
W76-07585

**STREAM BOTTOM ORGANISMS AS INDICATORS OF ECOLOGICAL CHANGE: PHASE II,**  
Lamar Univ., Beaumont, Tex. Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W76-07586

**HYDROLOGIC CHARACTERISTICS OF LAGOONS AT SAN JUAN, PUERTO RICO, DURING A JANUARY 1974 TIDAL CYCLE,**  
Geological Survey, Fort Buchanan, Puerto Rico.  
S. R. Ellis, and F. Gomez-Gomez.  
Available from the National Technical Information Service, Springfield, Va 22161, as PB-250 972, \$4.50 printed copy; \$2.25 microfiche. Water-Resources Investigations 38-75, January 1976. 45 p, 28 fig, 8 tab, 8 ref.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Sources Of Pollution—Group 5B

**Descriptors:** \*Tidal effects, \*Lagoons, \*Water quality, \*Flow rates, \*Puerto Rico, Data collections, Hydrologic properties, Salinity, Sewage effluents, Urban runoff, Industrial wastes, Canals, Surface waters, \*Path of pollutants.

**Identifiers:** \*San Juan(P R), Tidal cycle effects.

The lagoons in the San Juan area, Puerto Rico consist of Laguna La Torrecilla, Laguna de Pinones, Laguna San Jose, and Laguna del Condado. They are interconnected by canals, except for Laguna del Condado, which is connected to the other lagoons by way of Bahia de San Juan. The lagoons contain saline to brackish water, raw and partly treated sewage, urban runoff, and industrial effluents. Flows were measured and water-quality was sampled hourly for a tidal cycle (25 hours) in January 1974 at each connecting canal and outlet to the ocean. Interlagoon and ocean-lagoon flows, total organic carbon, total phosphorus, total orthophosphate, and suspended-sediment loads were calculated for a tidal cycle. Combined outflows of the Rio Puerto Nuevo and Caño de Martín Pena were calculated for the Caño de Martín Pena at the Constitution Bridge site. (Woodard-USGS) W76-07597

#### AQUIFER TESTS IN THE SUMMIT REACH OF THE PROPOSED CROSS-FLORIDA BARGE CANAL NEAR OCALA, FLORIDA, Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 2F.  
W76-07599

#### RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, MAY 1974, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 5A.  
W76-07606

#### RADIOCHEMICAL MONITORING OF WATER AFTER THE CANNIKIN EVENT, AMCHITKA ISLAND, ALASKA, AUGUST 1974, AND CHEMICAL MONITORING FROM JULY 1972 TO JUNE 1974, Geological Survey, Denver, Colo.

For primary bibliographic entry see Field 5A.  
W76-07607

#### POLLUTANTS 'FINGERPRINTED' BY RADIOACTIVE METHOD.

For primary bibliographic entry see Field 5A.  
W76-07629

#### LABORATORY MODEL STUDY OF THE EFFECTS ON THE AQUATIC MICROFLORA OF COAL-WASHING PLANT-GENERATED WASTE WATERS (SZENMOSO-UZEMI SZENVIZEKRE ELOVIZEKRE GYAKOROLT HATASNAK LABORATORIUMI MODELLVIZSGALATA).

J. Gellen, and J. Kenyeres.  
Banyaszati es Kohászati Lapok-Bányaszat, Vol. 106, No. 8, p 540-545, 1973. 13 fig, 4 ref.

**Descriptors:** \*Waste water treatment, \*Industrial wastes, Environmental effects, Aquatic plants, Aquatic microorganisms, Model studies, Chemical oxygen demand, \*Activated sludge.

**Identifiers:** Coal-washing wastes, Microflora.

The effect of coal-washing plant-generated waste water on aquatic microflora was studied in a model experiment, using phenol-adapted activated sludge for aquatic microflora, hard coal slurry for effluent, and sodium chloride for modeling salt loads. The relevancy of the COD value, determined by means of the strong oxidizing agent potassium dichromate, for the evaluation of the biologic oxidizability of coal-washing plant-generated effluents, was also investigated. Findings indicated that hard coal slurries are ready-

ly oxidizable chemically, but have negligible BOD<sub>5</sub> values. Inhibition of the activated sludge, and considerable reduction in the oxygen content of the system were found to occur only at extreme salt concentrations and pH values that are most unlikely to occur in practice. It was concluded that the biologic oxidizability of coal-washing plant-generated waste water, and consequently the treatment fees to be paid by coal-washing plants, should not be determined from the unrealistically high COD values obtained by the potassium dichromate method. (Takacs-FIRL) W76-07641

#### PROBLEMS RELATED TO THE RENEWED GROUNDWATER LEVEL RISE IN PREVIOUS MINING AREAS AS ILLUSTRATED BY THE SOUTHERN LUSATIA EXAMPLE (PROBLEME DES GRUNDWASSERWIEDERANSTIEGS IN EHEMÄLIGEN BERGBAUERGEBIETEN AM BEISPIEL DER SÜD-LAUSITZ).

K.-F. Busch, J. Quast, and L. Luckner.  
Wissenschaftliche Zeitschrift der Technischen Universität Dresden, Vol. 22, No. 4, p 660-663, 1973. 1 fig, 11 ref.

**Descriptors:** \*Groundwater, \*Water management(Applied), Mine water, Mining, Computers, \*Model studies, Environmental effects, Europe, Water pollution sources, Forecasting.

**Identifiers:** Groundwater level rise.

A territory-specific electro-analog model for the forecasting of the renewed groundwater level rise in abandoned surface mines was described, using the example of the Southern Lusatia surface mines. The simulation of the renewed groundwater level rise requires highly precise calculations for regional groundwater flow problems, and exact use of representative system parameters such as permeability and storage coefficients, as well as the location and effectiveness of the recipients, and the rate of groundwater formation. Problems related to the renewed rise of the groundwater levels can be solved by means of analogous electric resistance networks, or numerically by the use of digital computer. Model investigations of the Southern Lusatia surface mining area revealed an initial rapid rise in the groundwater level, followed by subsequent leveling-off due to the interactions between adjacent surface mines. The stationary final state of the groundwater level in abandoned surface mines, without supply from outside sources, is calculated to be reached in 20 to 25 years. Great influence of evaporation on the dynamics of renewed groundwater level rise was established. Model studies of the renewed groundwater level rise in abandoned surface mines are necessary for the planning of the recultivation of such sites and of future water management in such areas. (Takacs-FIRL) W76-07663

#### HEAVY METALS IN AGRICULTURAL LANDS RECEIVING CHEMICAL SEWAGE SLUDGES, VOLUME III,

Ontario Inst. for Environmental Studies, Toronto. For primary bibliographic entry see Field 5A.  
W76-07676

#### BIOLOGICAL AVAILABILITY OF MERCURY IN SWORDFISH (XIPHIAS GLADIUS).

Nabisco Research and Development Center, Fair Lawn, N. J.

For primary bibliographic entry see Field 5C.  
W76-07694

#### POLLUTION OF A TASMANIAN RIVER BY MINE EFFLUENTS: I. CHEMICAL EVIDENCE, Tasmania Univ., Hobart (Australia). Dept. of Botany.

P. A. Tyler, and R. T. Buckney.  
Int Rev Gesamten Hydrobiol. 58(6), p 873-883, 1973.

**Descriptors:** Water pollution sources, Discharge(Water), \*Water pollution effects, Industrial wastes, Chemical analysis, \*Mine water, Mine drainage, Mine wastes, \*Australia, \*Acid mine water, Zinc, Cadmium, Copper, Lead, Iron, Manganese, Dusts, Tungsten, \*Rivers.

**Identifiers:** Sulfuric acid, Tasmania, Particulates, South Esk River(Tas).

Discharge of effluents from tin and wolfram mines caused severe pollution of 2 creeks and lesser pollution of the South Esk River in North-East Tasmania. The principal pollutants are sulfuric acid, Zn, Cd, Cu, Pb, Fe and Mn in dissolved or particulate form or both. The creek waters were rendered unsuitable for domestic or agricultural use and all normal biota destroyed. In the South Esk River trout are absent from polluted reaches though abundant elsewhere. Flood-borne mine tailings, rich in particulate pollutants, have destroyed or degraded pastures along the South Esk River. (See also W76-07705)—Copyright 1974, Biological Abstracts, Inc.  
W76-07704

#### POLLUTION OF A TASMANIAN RIVER BY MINE EFFLUENTS: II. DISTRIBUTION OF MACROINVERTEBRATES, Tasmania Univ., Hobart (Australia). Dept. of Zoology.

V. J. Thorp, and P. S. Lake.  
Int Rev Gesamten Hydrobiol. 58(6), p 885-892, 1973.

**Descriptors:** \*Rivers, \*Australia, \*Water pollution effects, Effluents, Discharge(Water), \*Mine water, Cadmium, Resistance, Crustaceans, Molluscs, Annelids, Aquatic animals, Zinc, Cadmium, \*Invertebrates.

**Identifiers:** Arachnida, Hemiptera, Leptocerid trichopterans, South Esk River, Tasmania.

The distribution and abundance of macroinvertebrates were studied in the South Esk River, Tasmania; a river subject to Cd and Zn pollution as a result of mining. The groups most intolerant of Cd-Zn pollution were the Crustacea, Molluscs and Annelida. Highly tolerant groups included aquatic Hemiptera and Arachnida, and larvae of leptocerid trichopterans. A drop in both species diversity and abundance occurred after floods in winter and was probably due to pulses of Cd and Zn down the river and also to increased molar action of the unstable substrate. (See also W76-07704)—Copyright 1974, Biological Abstracts, Inc.  
W76-07705

#### INTENSIFIED FISH CULTURE COMBINING WATER RECONDITIONING WITH POLLUTION ABATEMENT, Kramer, Chin and Mayo, Seattle, Wash.

For primary bibliographic entry see Field 5G.  
W76-07711

#### STUDIES OF TOLERANCE TO HEAVY METALS IN THE FLORA OF THE RIVERS YSTWYTH AND CLARACH, WALES, University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.

For primary bibliographic entry see Field 5C.  
W76-07712

#### DDT RESIDUES IN COD LIVERS FROM THE MARITIME PROVINCES OF CANADA, Fisheries and Marine Service, Halifax (Nova Scotia). Inspection Branch.

For primary bibliographic entry see Field 5C.  
W76-07719

#### OIL TANKER POLLUTION CONTROL: DESIGN CRITERIA VS EFFECTIVE LIABILITY ASSESSMENT, Department of the Treasury, Washington, D.C.

For primary bibliographic entry see Field 5G.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5B—Sources Of Pollution

W76-07812

**NON-POINT POLLUTION IN THE POTOMAC RIVER BASIN,**  
Interstate Commission on the Potomac River,  
Bethesda, Md.  
R. N. Palmer.

ICPRB Tech. Pub. No. 75-2 (June 1975).

Descriptors: \*Potomac River, \*Watershed management, \*River basins, \*Water pollution control, \*Water management(Applied), Maryland, West Virginia, Virginia, Pennsylvania, District of Columbia, Water pollution source, Water pollution effects, Water pollution treatment, Water quality, Sediment, Bacteria, Nutrients, Abatement, Chemical reactions, Federal government, State governments, Sewers, Costs, Eutrophication, Pollution, Acid mine water.

Identifiers: \*Non-point sources(Pollution), \*Potomac River Basin, \*Acid mine drainage, Retention basins.

This booklet presents an overview of present non-point pollution problems in the Potomac River Basin, including discussion of the magnitude and effect of various pollution sources and abatement techniques. Non-point source pollution control-control of diffuse pollution sources-presents unique difficulties because of extreme quantity variations; consequently, it is necessary in addition to 'point source' control if water quality in this area is to be improved. There are four major non-point sources of pollution: (1) Acid mine drainage originating from coal mine runoff of which the ultimate pollution impact is area sterility. Abatement techniques are 'prevention' and 'treatment'. (2) Sediment pollution from both urban/suburban and rural areas which results from erosion and acid mine drainage, thereby decreasing the usefulness of water and altering the natural river ecology. Abatement approach is regulation by state and local governments. (3) Bacteria pollution originating from treated and untreated sewage and industrial discharge, storm water runoff and combined sewage overflows. Treatment is by separation of combined sewers and construction of retention basins. (4) Increasing nutrient discharge from municipal, agricultural and forest sources advances eutrophication rate presenting problems of water purification. Control centers around advanced waste treatment of point source discharges. (Hadoulias-Florida)

W76-07820

**NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY, EFFLUENT LIMITATIONS AND GUIDELINES,**  
Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07833

**ECOLOGICAL OBSERVATIONS ON SIMULIAE OF THE ARNONE RIVER AND INFUENTS OF THE BRACCIANO LAKE, (IN ITALIAN),**  
For primary bibliographic entry see Field 5C.  
W76-07936

**THE DISTRIBUTION OF STIGEOCLONIUM TENUE KUTZ. IN SOUTH WALES IN RELATION TO ITS USE AS AN INDICATOR OF ORGANIC POLLUTION,**  
University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.  
R. O. McLean, and K. Benson-Evans.  
Br Phycol J. 9(1), p 83-89, 1974.

Descriptors: Rivers, \*Algae, Pollutants, Analysis, \*Resistance, Organic wastes, \*Bioindicators, Pollutant identification, Path of pollutants, Distribution.  
Identifiers: \*Stigeoclonium-Tenue Kutz, Wales.

The distribution and frequency of *S. tenue* Kutz. in some South Wales rivers were studied for 12 mo. to assess the value of the alga as an indicator of organic pollution. It colonized organically polluted areas at most times of the year in greater abundance than at cleaner stations. Tolerance was observed over a wide range for a number of environmental factors: pH, water temperature, suspended solids content, flow nitrate, nitrite and ammonia nitrogen, phosphate phosphorus, dissolved oxygen, BOD (biological oxygen demand), electrical conductivity, chloride, total hardness, magnesium hardness and calcium hardness. Greatest tolerance was expressed mainly in the spring months when the organism became widely distributed in diverse habitats ranging from organically polluted to fairly clean conditions. Some precautions in the use of *S. tenue* as an indicator of organic pollution are suggested. The frequency of the organism should be noted especially in spring, since organic conditions are suspect only when the alga is highly abundant.--Copyright 1974, Biological Abstracts, Inc.

W76-07957

**PESTICIDE POLLUTION AND ITS ECOLOGICAL IMPLICATIONS, (IN FRENCH),**  
Paris-11 Univ., Orsay (France). Laboratoire de Zoologie.

For primary bibliographic entry see Field 5C.

W76-07983

**PRELIMINARY NOTE ON THE OBSERVATION OF TERRIGENOUS DRIFTS INTO THE SEA, OBTAINED BY MEANS OF TELEVISED PICTURES TRANSMITTED BY ARTIFICIAL SATELLITES, (IN FRENCH),**  
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.

G. Palusi.

Rev Int Oceanogr Med 39/40; p 171-176, 1975.

Descriptors: Remote sensing, Satellites(Artificial), Aerial photography, Industrial wastes, Path of pollutants.

Identifiers: France, Italy, \*Mediterranean Sea, Terrigenous drift.

Analysis of high-contrast television pictures of the Mediterranean shore taken by satellites showed terrigenous drifts and industrial pollution. Studies of Cote d'Azur and the Riviera (France, Italy) are presented.--Copyright 1975, Biological Abstracts, Inc.

W76-07992

**THE GULF AND THE ESTUARY OF THE SAINT-LAWRENCE RIVER: REVIEW OF THE PRINCIPAL PAPERS ON CHEMICAL OCEANOGRAPHY, (IN FRENCH),**  
Quebec Univ., Rimouski (Quebec). Dept. of Pure Sciences.

M. Khalil, and M. Arnac.

Rev Int Oceanogr Med 39/40; p 153-170, 1975.

Descriptors: St. Lawrence River, Oceanography, Estuaries, Water circulation, Trace elements, Water pollution sources, Pesticides, Oil wastes.

Intensive biological activities take place in the gulf and estuary of the St. Lawrence River (North America). The water circulation at the basis of any chemical or geochemical study is relatively well known. The composition of the particulate suspended matter in the estuary is richer in trace elements compared to the concentrations of the latter in the earth crust. Major constituents of surface waters collected in the Gaspe current seem to be of the same order of magnitude as the published data for sea-water. The concentrations of trace metals in the estuary and its effluent are of the same order. Where comparison is possible these values for the estuary are generally higher than those for the gulf. Contamination by organochlorine pesticides is not high. Petroleum

residue concentrations are not yet at harmful levels.--Copyright 1975, Biological Abstracts, Inc.  
W76-07933

**POLLUTION OF THE RUNOFF IN SEPARATE SEWER SYSTEMS, AND MEASURES FOR THE REDUCTION OF RAINWATER RUNOFF-GENERATED POLLUTION OF WATER BODIES (DIE VERSCHMUTZUNG DES ABFLUSS IM TRENNVERFAHREN SOWIE MASSNAHMEN ZUR VERMINDERUNG DER GEWAESSERVERSCHMUTZUNG INFOLGE REGENWASSEREINLEITUNGEN),**  
P. G. Brunner.

Gas-Wasser-Abwasser, Vol. 53, No. 4, p 109-113, May, 1973. 6 tab, 8 ref.

Descriptors: \*Storm runoff, \*Sewerage, Pollution abatement, Biochemical oxygen demand, Chemical oxygen demand, Nitrogen, Storm water, Retention, Phosphates, Air pollution, Sewers, Cleaning, Retention, Rainfall-runoff relationships.  
Identifiers: Orthophosphate.

Storm runoff pollution measurement in sewer systems conducted in Cincinnati, Ohio; Tulsa, Oklahoma; Ann Arbor, Michigan; and in Oxhey, England, as well as measures for pollution abatement of water bodies have been investigated. The filtrable matter content and dissolved solids content of the rainfall runoff in Tulsa ranged from 84 to 2052 mg/liter and from 89 to 400 mg/liter, respectively. The BOD<sub>5</sub> and COD values of the runoff in the four cities were in the ranges of 8-28 mg/liter and 42-138 mg/liter. The soluble orthophosphate content and the organic nitrogen content average 0.54-3.49 mg/liter and 0.36-2.10 mg/liter. This runoff pollutant load can be effectively reduced by intensified street clean-up, especially in March and April, and by global air pollution abatement. A Cincinnati experiment with storm water retention for 10 to 20 minutes in a retention basin gave results concerning (mediocre) pollution load abatement, (no) effect on bacteria count, and (fairly high) investment and operating costs. The rates of reduction in the BOD<sub>5</sub> value, the organic nitrogen, and total phosphate contents achieved after retention of 20 minutes in the four systems were 15, 33, 25, and 8 percent. (Sandoski-FIRL)  
W76-07997

**POLLUTION OF WATER BODIES BY ARTIFICIAL RUNOFF OF RAINWATER POLLUTION BY WASTE WATER OF MIXED SEWERS (BELASTUNG DER GEWAESSER DURCH KUNSTLICHE ABLEITUNG VON NIEDERSCHLAEGEN, BELASTUNG DURCH ABWAESSER DER MISCHKANALISATION),**  
K. Krauth.  
Berichte der Abwassertechnischen Vereinigung E.V., No. 25, p 97-115, 1973. 5 fig, 11 tab, 11 ref.

Descriptors: \*Sewerage, \*Storm runoff, Combined sewers, Treatment facilities, Rainfall-runoff relationships, Water storage.  
Identifiers: Rain storage basins.

In a two-year test series conducted in West Germany, runoff conditions specifically related to mixed sewer systems were determined during rainfall periods. Quantitative measurements were taken for 621 storm runoff periods with intensities greater than 7 cu ft/sec. Samples were taken of such short intervals that evaluation of the dirt load was feasible. Primary runoffs which flushed entire sewer systems, runoffs which succeeded primary runoffs, and runoffs which partly flushed the sewers, were considered. The results indicate that only temporary storage of the storm runoff and its subsequent purification help to reduce the dirt load. For maintaining a dirt load consistent with that occurring during dry weather, no water may pass the rain storage basin after it has been filled. Under present conditions the dry weather runoff goes directly to the purification plant and the

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

storm runoff directly to the receiving stream without treatment. (Nave-FIRL)  
W76-08009

**DATA TRANSMISSION SYSTEM MONITORS RIVER POLLUTION.**  
For primary bibliographic entry see Field 5A.  
W76-08028

**STORM DRAINAGE 'FILTERED' BEFORE DISCHARGE,**  
For primary bibliographic entry see Field 5G.  
W76-08032

**AN EVALUATION OF THE POTENTIAL FOR ECOLOGICAL DAMAGE BY CHRONIC LOW-LEVEL ENVIRONMENTAL POLLUTION BY FLUORIDE,**  
California Inst. of Tech., Pasadena. Div. of Humanities and Social Sciences.  
For primary bibliographic entry see Field 5C.  
W76-08038

**A STUDY OF THE MARINE RESOURCES OF HINGHAM BAY,**  
For primary bibliographic entry see Field 5C.  
W76-08039

**ARTIFICIAL RECHARGE THROUGH A WELL IN FISSURED CARBONATE ROCK, WEST ST. PAUL, MINNESOTA,**  
Geological Survey, St. Paul, Minn.  
For primary bibliographic entry see Field 4B.  
W76-08046

**EVALUATION OF GROUND-WATER CONTAMINATION FROM CLEANING EXPLOSIVE-PROJECTILE CASINGS AT THE BANGOR ANNEX, KITSAP COUNTY, WASHINGTON, PHASE II,**  
Geological Survey, Tacoma, Wash.  
J. V. Tracy, and N. P. Dion.  
Water-Resources Investigations 62-75 (open-file report), 1976. 44 p, 8 fig, 3 tab, 13 ref.

Descriptors: \*Water pollution sources, \*Groundwater, \*Waste disposal, \*Military reservations, \*Washington, Explosives, Leaching, Path of pollutants, Sampling, Water wells, Water analysis, Evaluation, Aquifer characteristics, Public health.  
Identifiers: U.S. Navy Bangor Annex(Wash), \*Projectile casings waste, TNT, RDX.

From 1966 through 1970 the U.S. Navy steam cleaned explosive-projectile casings at the Bangor Annex, Washington. The condensed waste water, containing explosive residuals, was channeled to a shallow, unlined disposal pit. The waste water recharges a shallow aquifer used for domestic water supplies. Prolonged exposure to the resources reportedly can cause deleterious physiological effects on humans. The Navy obtained the U.S. Geological Survey to make a study of the groundwater conditions. The extent of the contamination of both the groundwater and the earth materials is local, although the earth materials will provide a source of low-level contamination of percolating groundwater for many years. The estimates of TNT and RDX in the earth materials in the disposal pit indicate that very little RDX (300 pounds, 140 kg) remains in the materials and the TNT (9,500 pounds, 4,300 kg) appears to be well adsorbed on the clayey materials. Percolation of rain water over a period of years may slowly leach out the remaining TNT and RDX, but the concentrations of these leachates is not expected to be significantly different from those that currently exist in the groundwater under the disposal area. (Woodard-USGS)  
W76-08048

**SOLUTE TRANSPORT AND MODELING OF WATER QUALITY IN A SMALL STREAM,**  
Geological Survey, Menlo Park, Calif.  
S. M. Zand, V. C. Kennedy, G. W. Zellweger, and R. J. Avanzino.

Journal of Research of the U. S. Geological Survey, Vol 4, No. 2, p 233-240, March-April 1976. 8 fig, 2 tab, 9 ref.

Descriptors: \*Path of pollutants, \*Tracking techniques, \*Water quality, \*Streams, Small watersheds, Data collections, Mathematical models, Chlorides, Sodium, Methodology, Analytical techniques.  
Identifiers: \*Stable strontium, Mass transport.

An injection of chloride, sodium, and stable strontium was made at a constant rate for 3 hours into Uvas Creek, Santa Clara County, Calif., to determine the mass transport processes in a small stream. Five observation points were selected within a 610-meter reach of the stream below the injection site. Water samples were collected at the observation points during and immediately after the injection. A mathematical model of the stream was obtained by solving analytically and optimally the one-dimensional mass transport equation of the solutes in the stream. Comparison of field results with a simplified mathematical model indicates the dominance of convection in the behavior of sodium and chloride. The concentration of chloride and sodium can be closely simulated by the model. However, strontium cannot be well represented by the simplified model, which contains a first-order decay-type sink. (Woodard-USGS)  
W76-08058

**MIX2: A COMPUTER PROGRAM FOR MODELING CHEMICAL REACTIONS IN NATURAL WATERS,**  
Geological Survey, Reston, Va.  
For primary bibliographic entry see Field 7C.  
W76-08062

**IMPORTANCE OF WATER QUALITY IN THE USE OF LARGE VOLUMES OF WATER FOR CONDENSER COOLING IN POWER STATIONS,**  
Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.  
Indian Journal of Power and River Valley Development, Vol. XXV, No. 4, p 124-127, April 1975. 2 tab, 5 ref.

Descriptors: \*Water quality, \*Powerplants, \*Condensers, \*Cooling, \*Thermal pollution, \*Water chemistry, Lakes, Rivers, Effects, Nuclear powerplants, Water sampling.  
Identifiers: Impurities, Langlier method.

An important feature of a power station is the condenser which is used to condense steam coming out of the turbine. The obvious choice of a coolant for condenser cooling is water; depending on the location of the power station, it can be lake water, river water, or even sea water. For example at the nuclear power stations in India, sea water is used at TAPS and MAPP, while impounded Chambal water from Rana Pratap Sagar dam is used at RAPS. Furthermore, for economic reasons, Pallar river water is proposed for condenser cooling in the fast breeder test reactor coming up at Kalpakkam, even though it is situated on the coast. When lake or river water are used, apart from the fact that an abundant supply of coolant is assured throughout the year due to geographical and climatic conditions, the other main criteria are the quality of the coolant water and the cost of maintaining the required quality. This paper considers the importance of water quality in condenser cooling and discusses the use of river and lake water. Considered are impurities in water, the effect of impurities, chemical aspects, and other aspects. In view of the fact that nuclear power stations will play a larger role in coming years, the availability

of good quality water at inland locations for condenser and other system cooling has to be studied from all angles. (Bell-Cornell)  
W76-08070

**EQUITY CONSIDERATIONS IN CONTROLLING NONPOINT POLLUTION FROM AGRICULTURAL SOURCES,**  
Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.

For primary bibliographic entry see Field 5G.  
W76-08094

### 5C. Effects Of Pollution

**THE PLIGHT OF THE URBAN RESERVOIR: A CASE STUDY,**  
Rutgers - The State Univ., New Brunswick, N. J. Water Resources Research Inst.  
T. J. Tuffey, and H. Baker.  
Water Resources Bulletin, Vol. 11, No. 3, p 575-583, June 1975. 4 fig, 14 ref. OWRT A-043-NJ(1).

Descriptors: \*Reservoirs, \*Water quality, \*Land use, Eutrophication, Phosphorus, Recreation, \*New Jersey, Water pollution effects.  
Identifiers: \*Spruce Run Reservoir(NJ).

This paper details the increasing tendency to over-develop lands adjacent to public reservoirs. The impact on water quality of the pollutant load carried in surface runoff from developed lands is described, as well as the depreciation in recreational experience due to loss of scenic horizons. The case study, Spruce Run Reservoir in Clinton, New Jersey, included population and demand projection. Land speculation and proposed development are evaluated on a physical constraint basis. Areas of conflict are outlined and conflict resolutions proposed. (Bell-Cornell)  
W76-07452

**THE ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER ECOSYSTEM: PHASE II, IMPLICATIONS OF DIFFERENCES IN TRANSURANIC ISOTOPIC RATIOS,**  
Battelle-Pacific Northwest Labs., Richland, Wash.  
R. M. Emery, and T. R. Garland.

Available from the National Technical Information Service, Springfield, Va 22161 as BNWL-1879. \$4.00 in paper copy, \$2.25 in microfiche. BNWL-1879, December 1974. 26 p, 7 fig, 1 tab, 8 ref. AT(45-1):1830.

Descriptors: \*Environmental effects pollution, Radioactivity effects, \*Plutonium, \*Americium, Freshwater, Waste water(Pollution), Radioisotopes, Ecosystems.  
Identifiers: \*Transuramics, Ecological behavior.

Transuramics discharged into a freshwater processing waste pond created a complex combination of source terms and isotopic ratios. Relatively large amounts of U238 were released into the pond and, along with unidentified levels of Th232 and Th228 create a problem of interpreting the ecological behavior of Pu and Am in the ecosystem. Ratios of Pu238 to Pu239, Pu240 found in the pond are higher than those in the processing wastewater released to the pond. Ratios of Pu238 to Pu239, Pu240 and Am241 to Pu239, Pu240 are higher in the pond biota than in the sediments. To a lesser degree ratios of Am241 to Pu238 in the pond biota are also different. The data suggests that sediments in a trench carrying the processing wastes to the pond may be the primary source of Pu and Am. (Chilton-ORNL)  
W76-07480

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

**ABUNDANCE, DIVERSITY AND SEASONALITY OF FISHES IN COLORADO LAGOON, ALAMITOS BAY, CALIFORNIA,**  
California State Univ., Fullerton. Dept. of Biology.

L. G. Allen, and M. H. Horn.  
Estuarine and Coastal Marine Science, p 371-380,  
1975, Vol 3, 6 fig, 1 tab, 27 ref.

Descriptors: \*Fish, Populations, Seasonal, On-site investigations, Temperature, \*California, Bays, Seasonal, Lagoons, Killifishes.

Identifiers: Abundance, Diversity, Anchovy, Topsmeat, Shiner surfperch, Staghorn sculpin, California killifish.

The numbers of both fish species and individuals in Colorado Lagoon were highest from May to September and were highly correlated with lagoon temperature which ranged from 12.8 - 25.0 degrees C. 99% of the catch was made up of only four species, northern anchovy, topsmeat, slough anchovy and shiner surfperch. Five species, topsmeat, shiner surfperch, California killifish, staghorn sculpin, and slough anchovy, occurred in wide size ranges and during most of the year and were considered to be residents. Juveniles of northern anchovy were abundant in August and September. (Chilton-ORNL)

W76-07482

**THE EFFECT OF DIFFERENT LEVELS OF DIETARY FAT ON THE GROWTH OF RAINBOW TROUT (SMOON GAIRDNERI RICHARDSON),**

Stockport Technical Coll., Cheshire (England).

W. D. Atherton.

Journal of Fish Biology, Vol 7, p 565-571, 1975, 4 tab, 29 ref.

Descriptors: \*Fish diets, \*Growth rates, Feeds, Lipids, \*Rainbow trout, Laboratory tests.

Cod liver oil and lard were added to the diet of rainbow trout to investigate the level which would promote the greatest growth at selected temperatures of 12, 16, and 20 degrees C. Data indicated no significant changes in growth rates of fish fed lard at any of the selected temperatures. Levels of 15% or more of cod liver oil added to the diet had an adverse effect on fish at 12 and 16 degrees C. Cod liver oil added at levels of 5 and 10% promoted growth at these temperatures and all fish were affected adversely at 20 degrees C suggesting that the effects were due to temperature rather than dietary factors. (Chilton-ORNL)

W76-07483

**A COMPARISON OF THE EFFECTS OF TEMPERATURE ON WOUND HEALING IN A TROPICAL AND A TEMPERATE TELEOST,**

Stirling Univ. (Scotland). Unit of Aquatic Pathobiology.

C. D. Anderson, and R. J. Roberts.

Journal of Fish Biology, Vol. 7, p 173-182, 1975, 2 fig, 1 tab, 3 plates, 15 ref.

Descriptors: \*Fish, \*Laboratory tests, Minnows, Salmon, Temperature, \*Teleosts, Thermal effects, \*Thermal pollution, Water pollution effect.

Identifiers: Wounds, Healing.

The rate of healing of surgical wounds involving both integument and muscle was studied in two teleost fish. The species chosen were the white mountain cloud minnow (*Tanichthys albomaculatus*) which is a tropical cyprinid and the Atlantic salmon (*Salmo salar*) which is a temperate anadromous species. Comparisons were made of the rate and quality of wound healing within and between species at temperatures of 5, 10, 23, and 30 degrees C. The rate of wound healing at the tested temperatures increased with increasing temperatures while temperature stress had little effect on the healing rates. (Chilton-ORNL)

W76-07484

**THE INFLUENCE OF VARIOUS CULTURE CONDITIONS ON THE OXYGEN CONSUMPTION OF CHANNEL CATFISH,**  
Georgia Agricultural Experiment Station, Savannah; and Skidaway Inst. of Oceanography, Savannah, Ga.

J. W. Andrews, and Y. Matsuda.  
Transactions of the American Fisheries Society, Vol. 104, No. 2, p 322-327, 1975, 3 fig, 26 ref.

Descriptors: \*Oxygen requirements, \*Fish, \*Channel catfish, Environment, Temperature, Weight, Dissolved oxygen, Laboratory tests.

Identifiers: \*Oxygen consumption(Fish), Feeding(Fish).

Relationships between oxygen consumption of channel catfish and environmental dissolved oxygen concentrations, feeding status, weight of fish, and temperature were investigated. The rate of oxygen depletion in a still tank with no aeration was used to estimate oxygen consumption. At oxygen concentrations between 1 and 7 milligrams/liter a decrease in oxygen consumption rate with a decrease in environmental oxygen concentration was noted. The highest oxygen consumption rates were obtained one hour after feeding. The relationship between oxygen consumption and environmental temperature was linear over the range of 24-28 degrees C for well-fed fish and 24-30 degrees C for fasted fish. (Chilton-ORNL)

W76-07485

**A STUDY OF THE FAUNA IN DREDGED CANALS OF COASTAL LOUISIANA,**

Louisiana Wildlife and Fisheries Commission, New Orleans.

G. Adkins, and P. Bowman.

Technical Publication No. 18, February 1976, 72 p, 26 fig, 24 tab, 68 ref.

Descriptors: \*Wildlife, \*Coasts, \*Louisiana, Wetlands, Environment, Dredging, Canals, Salinity, Temperature, Dissolved oxygen, Foods, Freshwater, Sea water, Water chemistry.

Investigations of biological and hydrological parameters associated with artificial wetlands were made in four environments: open, unaltered areas; open canals; semi-open canals; and closed canals. 67,560 individuals representing 88 species were collected. Open, undisturbed areas offered the largest numbers of individuals and closed canals contained the fewest, although organisms in closed canals were larger in size. Salinity ranged from 30.0 to 0.1 parts per thousand, temperatures from 3.6 to 33.9 degrees C. Hydrological conditions were more stable in closed canals than in any of the other environments. Dissolved oxygen remained within tolerance limits of marine organisms during most of the study although some fish kills were seen in semi-open and closed canals. Water chemistry showed a trend of fluctuation dependent upon fresh water and salt water intrusion. Peak levels of nutrients were found after freshwater flooding conditions or storm surges. (Chilton-ORNL)

W76-07486

**FISHERIES AND ENERGY PRODUCTION: A SYMPOSIUM,**

1975, Lexington Books, D. C. Heath and Company, Lexington, Massachusetts, 237 p, Sails, S. B. Editor.

Descriptors: \*Entrainment, \*Model studies, \*Nuclear energy, Thermal pollution, Water pollution effects, \*Fish, Fish eggs, \*Larvae, Stress, Monitoring, Laboratory tests, On-site collections.

Ten papers on the subject of entrainment of fish and fish larvae are included. These include overviews on entrainment, field studies and laboratory studies on mechanical stresses, environmental monitoring, preference and avoidance temperatures as related to established standards, bypasses

and electrical barrier systems. (See W76-07488 thru W76-07497) (Chilton-ORNL)

W76-07487

**SIMULATING THE IMPACT OF THE ENTRAINMENT OF WINTER FLOUNDER LARVAE,**  
Rhode Island Univ., Kingston. Marine Experiment Station.

For primary bibliographic entry see Field 81.  
W76-07488

**SOME COMMENTS ON THE THERMAL EFFECTS OF POWER PLANTS ON FISH EGGS AND LARVAE,**

State Univ. of New York at Stony Brook. Marine Sciences Research Center.

J. R. Schubel.

In: Fisheries and Energy Production: A Symposium, p 31-54, 1975, 3 fig, 1 tab, 50 ref.

Descriptors: \*Thermal pollution, \*Water pollution effects, \*Entrainment, Fish eggs, Larvae, Stress.

An assessment is made from laboratory studies in which appropriate time-temperature histories have been used and from field studies at operating plants. Actual time-temperature histories depend upon plant design and the characteristics of the receiving waters. Site studies failed to establish the cumulative effects of pressure changes, mechanical agitation and other stresses to which organisms are subjected when carried through steam electric stations with once-through cooling systems. Data from laboratory studies which have been specifically directed at entrainment questions show that blueback herring, alewife, American shad, and striped bass eggs were able to survive exposure to typical time-excess temperature histories of at least 10 degrees C without any harmful effects. Larvae were generally able to withstand temperature increases of 12 degrees C above acclimation temperatures of 5 to 15 degrees C for 40 minutes without significant increases in mortality. (See also W76-07487) (Chilton-ORNL)

W76-07489

**ENVIRONMENTAL MONITORING THROUGH THE USE OF EXPOSURE PANELS,**

William F. Clapp Labs., Inc., Duxbury, Mass.

For primary bibliographic entry see Field 5A.

W76-07490

**THE MECHANICAL EFFECTS OF WATER FLOW ON FISH EGGS AND LARVAE,**  
Maryland Univ., Solomons, Md. Chesapeake Biological Lab.

For primary bibliographic entry see Field 81.  
W76-07491

**ENTRAINMENT OF ORGANISMS AT POWER PLANTS, WITH EMPHASIS ON FISHES - AN OVERVIEW,**

NUS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.

B. C. Marcy, Jr.

In: Fisheries and Energy Production: A Symposium, p 89-106, 1975 1 tab, 42 ref.

Descriptors: \*Entrainment, \*Fish, \*Powerplants, Fish eggs, Larvae, Environmental effects, Thermal effects, Stress, Intakes.

Available information on entrainment, including the components of inner-plant mortality such as thermal, mechanical and biocidal effects are discussed. Suggestions for reducing entrainment losses are presented. These include siting in non-productive areas, coordinating plant activities with organism densities, or going to closed cooling systems. The only immediately effective approach to minimize the adverse effect on entrained organisms is believed to be the lower intake volume concept. (See also W76-07487) (Chilton-ORNL)

W76-07492

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

#### THE ASSESSMENT OF IMPACT DUE TO ENTRAINMENT OF ICHTHYOPLANKTON,

Stone and Webster Engineering Corp., Boston, Mass. Environmental Engineering Div.

T. J. Horst.

In: *Fisheries and Energy Production: A Symposium*, p 107-118, 1975. 21 ref.

Descriptors: \*Entrainment, \*Environmental effects, \*Plankton, Fish eggs, Larvae, Populations, Ecosystems, Model studies.

Three approaches to impact assessment are presented. The organism approach estimates the probability of mortality for those organisms which are entrained. The population approach is the impact to fish populations which have egg and larvae stages entrained. The ecosystem approach considers the impact of entrainment to the whole community. The population approach offers the best promise for impact assessment, because models are available which are generally accepted and the impact can be assessed in terms of a basic biological unit, the species population. (See also W76-07487) (Chilton-ORNL)

W76-07493

#### LABORATORY AND FIELD TEMPERATURE PREFERENCE AND AVOIDANCE DATA OF FISH RELATED TO THE ESTABLISHMENT OF STANDARDS,

Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.

J. R. Stauffer, D. S. Cherry, K. L. Dickson, and J. Cairns Jr.

In: *Fisheries and Energy Production: A Symposium*, p 119-139, 1975. 8 fig, 29 ref.

Descriptors: \*Temperature, \*Resistance, \*Fish, Laboratory tests, On-site data collections, \*Fish behavior, Standards, Thermal pollution.

A relationship was shown between laboratory and field determined temperature preference data for the stoneroller, northern hog sucker, and channel catfish. On the basis of this relationship, temperature responses in situ of the smallmouth bass and spotted bass could be predicted from laboratory data. Temperature preference data of important species indicated that a thermal discharge of 7.7 degrees C higher than ambient temperatures would produce no appreciable harm to maintenance of a viable fish community. The most reasonable approach to establishing thermal standards is to couple temperature preference studies with site specific studies. (See also W76-07487) (Chilton-ORNL)

W76-07494

#### EXPERIMENTS RELATED TO DIRECTING ATLANTIC SALMON SMOLTS, SAIMO SALAR, AROUND HYDROELECTRIC TURBINES,

Fisheries and Marine Service, Halifax (Nova Scotia). Resource Development Branch.

For primary bibliographic entry see Field 81.

W76-07495

#### A LABORATORY STUDY ON THE EFFECTS OF THE EXPOSURE OF SOME ENTRAINABLE HUDSON RIVER BIOTA TO HYDROSTATIC PRESSURE REGIMES CALCULATED FOR THE PROPOSED CORNWALL PUMPED STORAGE PLANT,

New York Univ. Medical Center, N. Y. Inst. of Rehabilitation Medicine.

A. P. Beck, G. V. Poje, and W. T. Waller.

In: *Fisheries and Energy Production: A Symposium*, p 167-204, 1975. 6 fig, 11 tab, 14 ref.

Descriptors: \*Entrainment, \*Hydrostatic pressure, Fish, Growth stages, Mortality, Biota, Hudson River.

Identifiers: \*Acclimation pressure.

During entrainment, organisms will be exposed to rapid change in velocity shear forces, mechanical buffeting and turbulence as well as to changes in hydrostatic pressure. Based on the current analysis of the pressure regime expected at Cornwall, New York the likelihood of surviving the pressure exposure experienced during entrainment will depend on the life history stage entrained and its acclimation pressure. (See also W76-07487) (Chilton-ORNL)

W76-07496

#### THE EFFECTS OF TWO ELECTRICAL BARRIERS ON THE ENTRAINMENT OF FISH AT A FRESHWATER NUCLEAR POWER PLANT,

Rhode Island Univ., Kingston. Marine Experiment Station.

For primary bibliographic entry see Field 81.

W76-07497

#### PERSISTENCE OF DIQUAT IN THE AQUATIC ENVIRONMENT,

Wisconsin Univ., Madison. Water Resources Center.

G. V. Simsman, and G. Chester.

Water Research, Vol. 10, p. 105-112, 1975. 4 fig., 3 tab., 28 ref. OWRT B-016-WIS(18), 14-01-001-1567

Descriptors: \*Pesticide residues, \*Persistence, \*Diquat, Halogenated pesticides, Herbicides, Biodegradation, Lake sediments, Adsorption, Aquatic plants, \*Wisconsin, Lakes.

Identifiers: Lake Mendota(Wis), Lake Tomahawk(Wis).

Following a series of C14 Diquat labeled experiments in weed-infested and weed-free laboratory systems it was noted that although the herbicide has a short residence time in water, a tendency exists for Diquat to accumulate on sediment surfaces either directly or after sorption by aquatic life. The herbicide is released on decay of tissues and is subsequently bound by the sediment. Montmorillonite-adsorbed Diquat persists for longer periods than kaolinite- or vermiculite-adsorbed Diquat. Microbial Diquat degradation was promoted, apparently by rapid proliferation of microorganisms on the decomposing weeds. The clay mineral content of the predominantly montmorillonite contributed to the strong binding between Diquat and the sediment. Although Diquat is microbially degraded, adsorption by montmorillonite makes it less susceptible to breakdown. The persistence of Diquat added to heavily weed-infested aquatic systems is relatively short. In weed-free experiments, the Lake Mendota sediment adsorbed the herbicide almost completely in seven days and was faster in the anaerobic system than in the aerobic system. Microbial degradation of Diquat was noted by cumulative production of C14 labeled carbon dioxide. The higher degree of Diquat degradation in aerobic sediments is an indication that the microorganisms primarily responsible for Diquat breakdown are aerobes; under anaerobic conditions Diquat degradation is slower. (Auer-Wisconsin).

W76-07546

#### QUALITY AND QUANTITY OF NONPOINT POLLUTION SOURCES IN RURAL SURFACE WATER RUNOFF ON OAHU, HAWAII,

Hawaii Univ., Honolulu. Water Resources Research Center.

For primary bibliographic entry see Field 5B.

W76-07583

#### EFFECTS OF CAGE CULTURE OF CATFISH UPON WATER QUALITY IN RESERVOIRS,

Clemson Univ., S. C. Dept. of Entomology.

For primary bibliographic entry see Field 5B.

W76-07585

#### STREAM BOTTOM ORGANISMS AS INDICATORS OF ECOLOGICAL CHANGE: PHASE II,

Lamar Univ., Beaumont, Tex. Dept. of Biology.

R. C. Harrel, and J. L. Duplechin.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 763 \$4.50 in paper copy, \$2.25 in microfiche. Texas Water Resources Institute, College Station, Completion Report, May, 1976, 49 p, 3 fig, 6 tab, 38 ref. OWRT B-189-TEX(1), 14-31-0001-5116.

Descriptors: \*Sewage effluents, Surface runoff, Rice, Irrigation water, Invertebrates, \*Bioindicators, \*Texas, \*Municipal wastes, Benthos, \*Bottom organisms, Macrofauna, \*Ecological distribution, Water quality.

Identifiers: Hillebrandt Bayou(Tex.), Limnodrilus hoffmeisteri, Hexagenia limbata.

Effects of municipal sewage effluent, municipal surface runoff, and rice field irrigation water on physicochemical conditions and community structure of benthic macroinvertebrates in Hillebrandt Bayou were studied from September, 1974 to August, 1975. Physicochemical conditions were erratic due to frequent localized precipitation which affected surface runoff and quality and quantity of the sewage discharge. A total of 76 species and 71,178 individuals were collected during the study. Numbers of species per station ranged from 35 to 45. The dominant organism at all stations was Limnodrilus hoffmeisteri. Hexagenia limbata was collected at Station 1, above the sewage outfall, and at Stations 5 through 10. The information theory indices diversity per individual and redundancy, and equitability were used to determine community structure. Annual diversity per individual (d) and equitability (e) decreased at Station 3, located below the sewage outfall, then increased downstream to Station 9 and decreased at Station 10. Annual redundancy (R) exhibited the inverse relationship to d and e. On three of six collections d and e decreased at Station 10 due to increased numbers of Hexagenia limbata, a clean water species. Individual collection e values were very erratic. Mathematical indices and physicochemical data alone were not sufficient to evaluate water quality and community stress. However, these data together, correlated with knowledge of the organisms, allowed an accurate evaluation. (See also W74-10534)

W76-07586

#### FISH GROWTH RESPONSE TO MECHANICAL MIXING OF LAKE ARBUCKLE, OKLAHOMA,

Oklahoma Cooperative Fishery Unit, Stillwater.

R. C. Summerfelt, and G. Gebhart.

Available from the National Technical Information Service, Springfield, Va., 22161 as PB-252 762 \$5.50 in paper copy, \$2.25 in microfiche. Oklahoma Water Resources Research Institute, Stillwater, Completion Report, (1976). 104 p, 12 fig, 44 tab, 28 ref, append. OWRT A-048-OKLA(1), 14-34-0001-6037.

Descriptors: \*Reaeration, \*Growth rates, Distribution, Drums, Bullheads, Channel catfish, Mixing, Sunfishes, \*Oklahoma, Lakes, Fish, Desratification.

Identifiers: \*Lake Arbuckle(Oklahoma), \*Fish growth, \*Mechanical mixing, Gizzard shad.

Fish were sampled from 1973-75 to determine the effect of mechanical mixing of Lake Arbuckle, Oklahoma on the growth rate and depth distribution of gizzard shad, white crappie, freshwater drum, black bullhead and channel catfish. The vertical depth distribution, annual growth rate, instantaneous growth rate, seasonal growth rate and condition factors were determined for the above species. The vertical depth distributions of all species were compressed into the upper water layers by an anoxic hypolimnia during summer stratification and the distributions deepened substantially after fall overturn. No positive conclusions about annual growth rates could be resolved, but it appeared that growth was generally larger in 1974

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when the lake was partially mixed than in previous nonmixed years. Seasonal growth rates indicated that generally the major portion of the population growth occurred during the destratified overwinter period rather than the stratified summer period. Condition factors often decreased during the stratified summer interval and increased during the destratified period indicating better fish conditions when the lake was destratified.

W76-07587

#### COMMUNITY PRODUCTIVITY AND ENERGY FLOW IN AN ENRICHED WARM-WATER STREAM,

Michigan State Univ., East Lansing. Dept. of Fisheries and Wildlife.

R. L. Vannote, and R. C. Ball.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-242 023, \$6.75 in paper copy, \$2.25 in microfiche. Report No. MSU-IWR-TR-72-0027 (Technical Report No. 27), September 1972. 166 p. 23 fig., 18 tab., 196 ref. NIH RG-5345-C3

Descriptors: \*Energy transfer, \*Productivity, \*Streams, \*Warm-water fish, \*Bass, \*Energy loss, \*Michigan, Crayfish, Eutrophication, Primary productivity, Periphyton, Photosynthesis, Spawning, Standing crops, Aquatic plants, Biomass, Growth rates, Water circulation, Respiration, Dissolved oxygen, Urbanization, Turbidity, Pollutants, Water temperature.

Identifiers: \*Red Cedar River(Mich).

Productivity and energetics in the Red Cedar River, Michigan, a smallmouth bass stream, were studied by tracing energy flow patterns and quantifying energy losses from the primary trophic level through the major prey species (crayfish) to bass. Annual primary, macrophyte, and periphyton productivities and photosynthetic efficiencies were calculated. Crayfish were staple items in bass diets and the dominant form of biota. Energy assimilated by crayfish represented 9.4% of energy available at the primary level (0.00527% of incident light energy). Bass nesting density was 21-25 nests/linear stream mile. Postspawning stream conditions determined year class strength. The average bass standing crop was 14.9 kg/ha. Bass production was 13.6 kg/ha/year, representing 0.00024% of incident light energy and 0.14% of net primary production. Assuming crayfish were the only energy source for bass, harvesting efficiency was 14.6% of annual crayfish production. Due to non-assimilated energy losses and energy diverted for body maintenance, 3.6% of crayfish production was used for bass biomass growth. This ecosystem's complex interactions between photosynthesis, circulation, and total community respiration varied according to season and human impact. Further organic enrichment will depress night oxygen levels to a critical level for the stream biota. (Buchanan-Davidson-Wisconsin). W76-07608

#### FRESHWATER BIOLOGY AND POLLUTION ECOLOGY: TRAINING MANUAL.

Environmental Protection Agency, Cincinnati, Ohio. Office of Water Programs Operations.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-242 000, \$8.00 in paper copy, \$2.25 in microfiche. EO-A-430/1-75-005, April 1975. 242 p. 95 fig., 17 tab., 312 ref.

Descriptors: \*Freshwater, Biology, \*Water pollution, \*Ecology, \*Training, Aquatic algae, Aquatic animals, Aquatic bacteria, Aquatic fungi, Freshwater fish, Plant groupings, Animal groupings, Biological communities, Zooplankton, Waste water, Organic compounds, Periphyton, Invertebrates, Self-purification, Water quality, Estuaries, Toxicity, Bioassay, On-site investigations, Benthos.

Identifiers: \*Training manual.

This manual, covering the broad field of freshwater biology and pollution ecology, was designed as an introductory course for sanitary engineers, aquatic biologists, and others concerned with freshwater pollution studies and abatement programs. It includes teaching outlines on the biology and identification of major plant and animal groups, pollution effects, biological pollution indices, and methods of collecting and analyzing freshwater communities. The first section is devoted to surveys of biota. The components of the aquatic community are reviewed to help the observer recognize common types of organisms found in field, laboratory, and treatment facilities. The aquatic environment, production of excess organic matter, and types of algae, macrophytes, animals, microscopic invertebrates of wastewater treatment plants, zooplankton, macroinvertebrates, fish, and fungi are described. The second section discusses pollution ecology: biological aspects of natural self purification, interpretation of biological data with reference to water quality, effects of pollution on aquatic life, global deterioration and the environmental crisis, toxicity bioassays, biological field methods, stream invertebrate drift, artificial substrates, attached growths (periphyton or aufwuchs), application of biological data, and use of benthic biota for water quality evaluation. (Buchanan-Davidson-Wisconsin). W76-07611

#### INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF PARATHION.

Midwest Research Inst., Kansas City, Mo.

For primary bibliographic entry see Field 5G.

W76-07612

#### TAXONOMIC DIFFICULTIES IN RED TIDE AND PARALYTIC SHELLFISH POISON STUDIES: THE 'TAMARENSIS COMPLEX' OF CONYUAULAX.

British Columbia Univ., Vancouver. Inst. of Oceanography.

F. J. R. Taylor.

Environmental Letters, Vol. 9, No. 2, p. 103-119, 1975. 10 fig., 1 tab., 24 ref.

Descriptors: \*Systematics, \*Red tide, Toxicity, Dinoflagellates, Atlantic ocean, Pacific Ocean, Plant physiology, Plant morphology.

Identifiers: \*Gonyaulax, \*Gonyaulax tamarensis, Thecal morphology, Gonyaulax excavata, Gonyaulax phoneus, Gonyaulax acatenella, Gonyaulax fratercula, Gonyaulax conjuncta, Gonyaulax catenella, Gonyaulax cohorticula, Gonyaulax series.

At least three species of the dinoflagellate genus Gonyaulax form similar potent neurotoxins, but their recognition is confused. The history of the problem is described. Gonyaulax tamarensis type illustrations contained an apparent reversal of epithelial plates and cultures from the type locality were not toxic, thus allocation of toxic populations in the North Atlantic to this species or a variety (var. excavata) is doubtful. The latter was designated as a distinct species, but given the wrong name (G. excavata) instead of G. phoneus. Criteria for recognizing other similar species are summarized. Variability in plate patterns observed in cultures of G. tamarensis var. excavata from British Columbia is demonstrated, and its bearing on Gonyaulax taxonomy is discussed. Finding this toxic variety on the west coast of North America is new. Emphasis should not be placed on small differences in shape or size of certain plates unless little variability is observed. Studies are needed on species distribution, variability thecal morphology, and physiological properties. At least three toxic taxa appear on the west coast. Toxic populations of G. tamarensis appear to be var. excavata. If it is a distinct species, it should not be identified as G. excavata but as G. phoneus. (Buchanan-Davidson-Wisconsin). W76-07614

THE 1971 RED TIDE AND ITS IMPACT ON CERTAIN REEF COMMUNITIES IN THE MID-EASTERN GULF OF MEXICO,  
Florida Dept. of Natural Resources, St. Petersburg, Marine Research Lab.

G. B. Smith.

Environmental Letters, Vol. 9, No. 2, p. 141-152, 1975. 1 fig., 1 tab., 16 ref.

Descriptors: \*Red tide, \*Reefs, \*Biological communities, \*Mortality, \*Gulf of Mexico, Florida, Succession, On-site investigations, Fishes, Coral, Mollusks, Crustaceans, Annelids, Benthic flora, Benthic fauna, Oxygen sag, Gymnodinium, Turbidity, Thermocline, Hypolimnion, Environmental effects.

Identifiers: \*Ecological impact.

The effects of the 1971 spring-summer red tide on mid-eastern Gulf of Mexico patch reef communities are described, based on in situ SCUBA observations at scattered sites off Sarasota, Florida. Reef fishes, scleractinian and alcyonarian corals, mollusks, decapod crustaceans, polychaetous annelids, tunicates, poriferans, echinoderms, and benthic algae sustained heavy mortalities, although mortalities of benthic reef invertebrates may not have been due to Gymnodinium breve toxins but to secondary effects (oxygen depletion, hydrogen sulfide poisoning, bacterial and fungal infections). Under proper environmental conditions, red tides can cause almost complete destruction of shallow-water reef biotas from large areas of the inner central-West Florida Shelf. Recolonization by certain biotic groups (benthic algae and fishes) is relatively rapid, but that of others (scleractinian and alcyonarian corals and echinoderms) may require several years. Seasonal and true ecological progression after certain red tides may temporarily cause floral and faunal assemblages to be qualitatively and quantitatively different from those prior to the red tide. Red tides, especially those generated beneath pronounced thermoclines, may regulate the composition, abundance, and distribution of shallow-water reef biotas in mid-eastern Gulf of Mexico. Periodic occurrence of red tides may prevent evolution of climax or equilibrium reef communities. (Buchanan-Davidson-Wisconsin). W76-07615

#### LAND DRAINAGE AS A FACTOR IN 'RED TIDE' DEVELOPMENT,

Department of the Environment, Ottawa (Ontario). Shellfish Water Quality Div.

A. Prakash.

Environmental Letters, Vol. 9, No. 2, p. 121-128, 1975. 20 ref.

Descriptors: \*Surface drainage, \*Dinoflagellates, \*Red tide, \*Environmental effects, Growth rates, Coasts, Salinity, Pollutants, Trace elements, Humus, Productivity, Organic matter.

Identifiers: Gonyaulax.

The mechanisms and factors involved in the development of red tides are not completely understood, but coastal red tides are primarily caused by a spectacular growth of marine dinoflagellates. Generally marine dinoflagellates thrive best under conditions of low salinity and high organic enrichment, conditions especially found in areas of river discharge and/or after heavy rainfalls. Indirect evidence suggests that heavy rainfall or land drainage is a prerequisite to most dinoflagellate blooms in coastal waters. Most marine dinoflagellates in laboratory cultures show optimal growth in salinities much below those of coastal waters. Land drainage lowers salinity of coastal waters and contributes to stratification, photic zone stability, convergence, and other mechanisms which may influence or control dinoflagellate growth. Biologically active substances, such as vitamins, chelators, antibiotics, auxins, decomposition products, extracellular metabolites, and humic compounds, are important factors in phytoplankton productivity. There is ex-

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perimental evidence that humic substances exert a stimulatory effect on marine dinoflagellates and that maximum growth responses are generated by predominantly low molecular weight, water soluble humic fractions; consequently humus-laden runoff could create conditions conducive to red tide development. Sewage outfall discharges containing organic material may also create conditions favorable to dinoflagellate growth and development of red tides. (Buchanan-Davidson-Wisconsin)  
W76-07616

**SOME OF THE GROWTH CHARACTERISTICS OF GONYAULAX TAMARENSIS ISOLATED FROM THE GULF OF MAINE,**  
Salem State College, Mass. Dept. of Biology.  
E. J. Cole, C. M. Yentsch, C. S. Yentsch, and M. Salvaggio.

Environmental Letters, Vol. 9, No. 2, p. 153-166, 1975. 5 fig., 13 ref.

Descriptors: \*Red tide, \*Growth rates, \*Nuisance algae, \*Gulf, Light intensity, Maine, Water temperature, Chlorophyll, Cultures, Nitrates, Marine algae, Temperate, Canada, Dinoflagellates.

Identifiers: \*Gonyaulax tamarensis, Dunaliella, Phaeodactylum, \*Gulf of Maine.

Gonyaulax tamarensis isolated from the Gulf of Maine during a red tide outbreak in September 1972 was studied. Light saturation curves were characteristic of shade species, and it is not unique in its capacity to use light. Optimal growth occurred at 18°C. Encystment and no net growth were characteristic at 5°C. Division rates were less and chlorophyll concentrations only slightly above those observed in 1972 bloom. The major difference in growth between axenic and non-axenic cultures was the long lag in axenic cultures; after three weeks the growth rates were almost identical. Changes in nitrate consumption correlated inversely with changes in chlorophyll. No marked low nitrogen requirement was observed compared to Dunaliella and Phaeodactylum. Similar chlorophyll levels/unit nitrate were found in Gonyaulax and Phaeodactylum, which had about half as much chlorophyll/unit nitrate as Dunaliella. Gonyaulax was a typical temperate phytoplankton and responded much like other phytoplankton to the parameters tested; its responses were identical to those of a Canadian Gonyaulax. The seed source may have come from Northern to Southern Gulf of Maine waters but not from an independent race. Several conjectures for the dominance of *G. tamarensis* at the time of the outbreak are discussed. (Buchanan-Davidson-Wisconsin).  
W76-07617

**REPORT ON A BIOCHEMICAL RED TIDE REPRESSIVE AGENT,**  
University of South Florida, Tampa. Dept. of Chemistry.  
E. C. Kutt, and D. F. Martin.

Environmental Letters, Vol. 9, No. 2, p. 195-208, 1975. 3 fig., 3 tab., 18 ref.

Descriptors: \*Chemcontrol, \*Biocontrol, \*Red tide, \*Gymnodinium, Estuaries, Nuisance algae, \*Florida, Economic impact, Predation, Cyanophyta, Fish toxins, Algal toxins, Nutrient requirements, Biodegradation, Dispersion, Gulf of Mexico, Coasts.

Identifiers: \*Gymnodinium breve, Tintinnids, Gymnosphaera aponina.

Estuarine red tides caused by definite species tend to occur yearly at specific times off the Florida coast; whether they spread and develop into catastrophic blooms depends on availability of a suitable environment and/or absence of competing or predator organisms. Naturally occurring organisms promising for red tide control are, in cool waters, a ciliate Tintinnid which grazes on red tide organisms and in warm waters, the cyanophyte *Gymnosphaera aponina*, which inhibits Gym-

nodinium breve growth and excretes a toxic substance (aponin). *Gymnosphaera* grows rapidly. Its deleterious effect on *Gymnodinium* is probably not due to nutrient depletion but may be due to biochemical interrelations, such as environmental regulation by external metabolic production. The aponin caused up to 95% *Gymnodinium* mortality. Fish showed extensive gill reddening and died in 24 hours. The effects of salinity, temperature dependence, and nutrition on *Gymnosphaera* must be studied. Stability, degree of non-absorptiveness, resistance to biodegradation, and capacity of the watermass to minimize dispersion of metabolites must be considered. Treatment of small areas with biochemical agents could prevent major blooms. If treatment of areas where red tides are first detected is followed by concentration by the same forces which concentrate *Gymnodinium*, red tides might not be a threat. (Buchanan-Davidson-Wisconsin).  
W76-07618

**IMPLICATIONS OF DINOFLAGELLATE LIFE CYCLES ON INITIATION OF GYMNOODINUM BREVE RED TIDES,**

Florida Dept. of Natural Resources, St. Petersburg. Marine Research Lab.

K. A. Steidinger.

Environmental Letters, Vol. 9, No. 2, p. 129-139, 1975. 2 tab., 50 ref.

Descriptors: \*Dinoflagellates, \*Gymnodinium, \*Red tide, \*Life cycles, \*Diapause, Florida, Growth stages, Estuaries, Coasts, Germination, Dormancy, Life history studies, Reproduction, Temperature, Environmental effects, Varieties, Gulf of Mexico.

Identifiers: Sexual reproduction, Offshore, Benthic resting cyst stages.

Knowledge of benthic and pelagic stages in life cycles is needed to understand dinoflagellate distribution, seasonal growth patterns, and succession in coastal and estuarine waters. Ten dinoflagellate life cycles are known to include germination and formation of pelagic motile and non-motile or benthic nonmotile zygotes. Knowledge concerning germination, dormancy, and sexuality is reviewed. Copulation may occur at specific cell surface sites. Sexual reproduction is slow, occurs at specific times in the life cycle, and can proceed undetected. Some dinoflagellates have resting cysts (dormant stages, often with thick walls). Temperature may be the key environmental factor in encystment. Species with and without armored cysts are listed. Cysts may be zygotes, dormant, or form seed populations. *Gymnodinium* breve red tides along Florida's west coast usually begin 18-74 km offshore but can be brought shoreward, depending on currents, winds, and cell longevity. Initial blooms are localized, suggesting existence of seed beds. If *Gymnodinium* breve has a benthic resting stage, seed populations or seed beds might be mapped. Further life cycle studies on differences in morphological and/or cytological generations, length of dormancy, and factors influencing encystment and excystment on *Gymnodinium* breve and other dinoflagellates associated with red tides would contribute to control measures. (Buchanan-Davidson-Wisconsin).  
W76-07619

**AN ANALYTICAL STUDY OF THE ROLE OF VARIOUS FACTORS CAUSING RED TIDE OUTBREAKS OF TRICHODISMUM AS DEDUCED FROM FIELD AND LABORATORY OBSERVATION,**

V. C. Ramamurthy.

Environmental Letters, Vol. 9, No. 2, p. 179-193, 1975. 4 fig., 1 tab., 28 ref.

Descriptors: \*Red tide, \*Marine algae, Subtropic, Fish food organisms, Nutrient requirements, \*Cyanophyta, Beneficial use, Nitrates, Phosphates, Growth rates, Nitrogen fixation.

Identifiers: \*Trichodesmium erythraeum, Gibberellic acid.

The marine blue green alga *Trichodesmium* is often found during red tides in sub-tropical areas. Fish mortality during *Trichodesmium* outbreaks may be due to asphyxiation rather than toxins, as it is an important fish food source. *Trichodesmium* outbreaks are also new nitrogen sources to the nitrogen demand of tropical oceans. When the effect of gibberellic acid on *Trichodesmium* erythraeum and the diatom *Melosira* sulcata cell multiplication was studied, there was an increase in cell population density as a function of gibberellic acid concentration to a maximum level. Gibberellic acid accelerated cell division, reducing the interval between successive divisions. One causative factor of red tides may be the presence of growth-promoting substances, rather than upwelling or rainfall. Red tides appear in the warmest seasons during periods of light winds. *Trichodesmium* cultures were not markedly affected by increasing nitrate or phosphate concentrations above normal levels. When the phosphate concentration was decreased below normal, the cells began to disintegrate and decompose; when the nitrate concentration was decreased, the cells remained viable but failed to multiply. In nitrogen-free media, cell multiplication in terms of nitrogen fixation increased rapidly. *Trichodesmium* erythraeum thrives and multiplies in nitrogen-impaired waters. When and where red tides will occur cannot be predicted. (Buchanan-Davidson-Wisconsin)  
W76-07620

**OCCURRENCE OF FORAMINIFERA, MOLLUSCS AND OSTRACODS ADJACENT TO THE INDUSTRIALIZED SHORELINE OF CANSO STRAIT, NOVA SCOTIA,**

Bedford Inst. of Oceanography, Dartmouth (Nova Scotia).

C. T. Schafer, F. J. E. Wagner, and C. Ferguson.

Water, Air and Soil Pollution, Vol. 5, No. 1, p. 79-96, 1975. 10 fig., 2 tab., 20 ref.

Descriptors: Marine animals, \*Bioindicators, \*Crustaceans, \*Distribution patterns, \*Water pollution effects, \*Mollusks, \*Canada, Industrial wastes, Snails, Straits, Sea water, Metals, Trace elements, Varieties, Bottom sediments, Copper, Iron, Manganese, Zinc, Carbon.

Identifiers: \*Foraminifera, \*Ostracods, Canso Strait (Nova Scotia).

Distributions and relationships between foraminifera, molluscs, and ostracods in moderately polluted portions of Canso Strait, Nova Scotia, showed high, moderate, and low tolerances to industrial effluents, respectively. Particulate matter near the industrialized shore contained adsorbed and complexed trace metals. Maps of species distributions and trace metal concentrations indicated that contaminated surface water movement was usually southward. Sediment particle size was controlled by water depth except near the industrialized shore where bottom sediments were characterized by anomalous copper, iron, manganese, zinc, and organic carbon concentrations. Foraminifera productivity was low near the industrialized shore and high in shallow environments where sediments contained 0.5 to 1.0% organic carbon. Foraminifera species diversity and abundance correlated with bottom sediment zinc levels. Pollutant stressed environments contained large numbers of the foraminifer *Eggerella advena*, *Elphidium incertum/clavatum* group, the mollusc *Modiolus modiolus*, and ostracods including *Baffinicythere emarginata* and *Muellerina canadensis*. Biological and chemical parameters were used to formulate pollution indices. The area between the foraminifer and ostracod barren zones edges defined a polluted but inhabitable subnormal zone. (Buchanan-Davidson-Wisconsin).  
W76-07621

**LIGHT DEPENDENT DDT-EFFECT ON MICROALGAE, (IN GERMAN),**  
Technische Universitaet, Freising-Weihenstephan (West Germany).

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

H. Witsch, A. Munz, and C. Scheibe.  
Berichte der Deutschen Botanischen Gesellschaft,  
Vol. 88, No. 2, p. 191-196, 1975. 1 fig., 9 ref.

Descriptors: \*Algae, \*Pesticide toxicity, \*DDT, Light intensity, Algal control, Resistance, Water pollution effects, Environmental effects.

Identifiers: *Microcystis aeruginosa*, *Coelastrum proboscideum*.

The dry weight increase in (mg/100 ml) cultures of the algae *Microcystis aeruginosa* and *Coelastrum proboscideum* were measured in relation to the influence of DDT and on initial light-shocks of various intensities. High light-energy alone remarkably depressed growth of *Microcystis aeruginosa* and increasing light intensity also enhanced its sensitivity to DDT. *Coelastrum proboscideum* was largely insensitive to radiation as well as to the combination of light and DDT. It is stressed that data on the sensitivity or tolerance of an algal species to DDT must include all variables, or must specifically define conditions, because additional factors strongly influence these reactions. (Auen-Wisconsin).  
W76-07622

ACCUMULATION OF MERCURY BY FISH OF THE LITTLE PINEY RIVER AND MILL CREEK,  
Missouri Univ., Rolla. Dept. of Chemistry.  
For primary bibliographic entry see Field 5A.  
W76-0760

CHARACTERIZATION OF LIMNETIC ZOOPLANKTON PHOSPHORUS EXCRETION AND FACTORS AFFECTING TEMPORAL EXCRETION RATES IN THE PHOSPHORUS CYCLE IN A LAKE,  
New Hampshire Univ., Durham. Dept. of Zoology.

J. G. Ferrante.

Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 857, \$5.00 in paper copy, \$2.25 in microfiche. PhD thesis, September 1974, 69 p. 12 fig., 8 tab., 57 ref. OWRT A-029-NH (2).

Descriptors: \*Cycling nutrients, \*Zooplankton, \*Phosphorus, Seston, Hypolimnion, Epilimnion, \*New Hampshire, Absorption, Model studies, Organophosphorus compounds, Solubility.  
Identifiers: \*Phosphorus excretion, Stonehouse Pond(NH), Orthophosphates.

Temporal and spatial excretion rates were studied by determining changes in soluble reactive phosphorus following incubation of zooplankton (smaller or larger than 0.308 mm) collected from the epilimnion and hypolimnion of Stonehouse Pond, New Hampshire. Temporal excretion rates varied within size groups; similar patterns were observed in both strata. Excretion rates were high in spring and fall and low in winter. Smaller animals excreted at higher rates. Excretion rates were higher by animals in the epilimnion compared to the hypolimnion. Phosphorus uptake by natural seston was compared to the amount released by zooplankton. In the spring of 1973, excretion rates increased but were offset by greater increases in the phosphorus uptake rate by seston, suggesting that at this time zooplankton phosphorus excretions were not enough to supply the amount of phosphorus being removed by seston. Phosphorus excretion studies of zooplankton collected in the spring of 1974 showed that the soluble phosphorus component released from natural populations had the same molecular weight as orthophosphate and behaved similarly in seston incorporation studies. Approximately 15% of total phosphorus was organic but could not be identified by ultraviolet spectroscopy. There was no evidence of nucleic acid excretion or hydrolytic degradation products. (Buchanan-Davidson--Wisconsin).  
W76-07675

### AN OUTBREAK OF SHIGELLA SONNEI GAS-TRENTERITIS ON COLORADO RIVER RAFT TRIPS,

Center for Disease Control, Atlanta, Ga.  
M. H. Merson, D. A. Goldman, K. M. Boyer, N. J. Peterson, and C. Patton.  
Am J Epidemiol. 100(3), p 186-196, 1974.

Descriptors: \*Colorado River, \*Human diseases, Public health, \*Shigella, Enteric bacteria, Water analysis, Bacteriology, Chemical analysis, Waste disposal.

Identifiers: Rafts, *Shigella-Sonnei*.

In the summer of 1972 an outbreak of acute gastroenteritis occurred among passengers and boatmen on Colorado River raft trips. The illness was characterized by diarrhea, abdominal cramps, and fever. Laboratory results indicated that the outbreak was caused by *S. sonnei*. The illness originated among the boatmen and spread to passengers primarily by person-to-person transmission. No common food or water vehicle could be identified as the source of the outbreak. A bacteriologic and chemical analysis of water from the Colorado River and some of its tributaries demonstrated that this water is unsuitable for drinking unless purified. The Colorado River Health Committee was created to establish guidelines for food and water handling and sewage disposal aboard the rafts and to initiate a health training course for boatmen.--Copyright 1975, Biological Abstracts, Inc.

W76-07691

### BIOLOGICAL AVAILABILITY OF MERCURY IN SWORDFISH (XIPHIAS GLADIUS),

Nabisco Research and Development Center, Fair Lawn, N. J.

B. R. Stillings, and H. R. Lagally.

Nutr Rep Int. 10(5), p 261-267, 1974.

Descriptors: \*Mercury, Fish, Chlorides, Rodents, Absorption, Biology, Bioassay, Biochemistry.

Identifiers: \*Swordfish, *Xiphias-Gladius*, Methylmercuric chloride.

In a study with weanling rats, the biological availability of Hg in swordfish was compared to that in methylmercuric chloride. Rats fed swordfish excreted significantly more Hg and retained slightly less in tissues. The biological availability of Hg in swordfish is slightly lower than that in methylmercuric chloride.--Copyright 1975, Biological Abstracts, Inc.

W76-07694

### AN ENZOOTIC NUCLEAR POLYHEDROSIS VIRUS OF PINK SHRIMP: ULTRASTRUCTURE, PREVALENCE, AND ENHANCEMENT,

Environmental Protection Agency, Gulf Breeze, Fla. Gulf Breeze Environmental Research Lab.

J. A. Couch.

J Invertebr Pathol. 24(3), p 311-331, 1974.

Descriptors: \*Viruses, Shrimp, \*Pink shrimp, Biology, Gulf of Mexico, \*Cytological studies.

Identifiers: *Baculovirus*, \*Enzootic nuclear polyhedrosis virus, *Penaei*, *Penaeus-Duorarum*.

A nuclear polyhedrosis virus exists in pink shrimp, *Penaeus duorarum*, from waters of the northern Gulf of Mexico. This virus is rod-shaped, 269 nm long and possesses an outer envelope surrounding its nucleocapsid. The nucleocapsid is 50 nm in diameter. The virus occurs in nuclei of host hepatopancreatic and midgut cells and is both free in the nucleus and occluded within pyramidal-shaped polyhedral inclusion bodies (PIB's). Histochemically and ultrastructurally, the shrimp PIB's appear to be ribonucleoprotein and in fine structure bear close resemblance to polyhedral inclusion bodies of *Baculovirus* species from insects. The lattice line-to-line spacing is greater than that usually reported for insect PIB's. Crowding, chemical stress of shrimp in aquaria may

enhance and increase the virus infection and prevalence. In limited experiments, shrimp fed heavily infected hepatopancreatic tissues had much higher mortality than controls fed only fish. The virus appears to be enzootic in pink shrimp, in nature. Cytopathological changes in infected cells of shrimp appear similar to those in insects infected with certain species *Baculovirus penaei* n. sp. is proposed for the shrimp virus.--Copyright 1975, Biological Abstracts, Inc.

W76-07695

### ORGANOCHLORINE PESTICIDE RESIDUES IN CULTURED FISHES OF TAIWAN,

Academia Sinica, Taipei (Taiwan). Inst. of Zoology.

S. S. Jeng, and L. T. Sun.

Bull Inst Zool Acad Sin Taipei. 13(1), p 37-46, 1974.

Descriptors: Pesticide residues, Fish, Asia, Shellfish, Oysters, Clams, Gas chromatography, Pollutant identification, DDT, Aldrin, Endrin, Dieldrin, Heptachlor, Pollutant identification.

The 1st report on organochlorine pesticide residues in cultured fishes and shellfishes of Taiwan suggests that the aquatic animals are not contaminated by pesticides. From Sept. 1972-Sept. 1973, 167 fishes belonging to 5 spp., 631 oysters and 20 clams were analyzed. No aldrin, endrin, heptachlor and heptachlor epoxide were detected within the sensitivity limit of the gas chromatographic method in all the fish and shellfish examined. Small residues of the BHC group were present in almost all the fish and shellfish with the maximum value not higher than 0.16 ppm in fish muscle or viscera. Also present in the edible portions of the fish and oysters were small amounts of DDT group compounds with values less than 0.15 ppm. DDT and its metabolites were not detected in clams. An insignificant amount of dieldrin (less than 0.05 ppm) was found in fish. The use of organochlorine pesticides in the past 20 yr did not result in significant accumulations of organochlorine pesticides in the fishes and shellfishes to render them unsuitable for human consumption.--Copyright 1975, Biological Abstracts, Inc.

W76-07697

### TOXICITY OF INSECTICIDES (COMMERCIAL FORMULATIONS) TO THE EXOTIC FISH, COMMON CARP CYPRINUS CARPIO COMMUNIS LINNAEUS,

Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology-Entomology.

H. S. Toor, K. Mehta, and S. Chhina.

J Res Punjab Agric Univ. 10(3), p 341-345, 1973.

Descriptors: \*Insecticides, \*Toxicity, \*Fish, \*Carp, \*Water pollution effects, Endrin, Resistance.

Identifiers: *Cyprinus-Carpio-Communis*, *Dimethoate*, *Endosulfan*, *Malathion*, Exotic fish.

The tests were conducted to determine the toxic effects (relevant to environmental pollution) of endrin, endosulfan, dimethoate and malathion. Emulsions of these insecticides were tested against small specimens measuring 7.5 to 10.5 cm. Endrin proved to be the most toxic, followed by endosulfan, malathion and dimethoate. The threshold toxicity and the maximum sublethal doses for the endrin were 0.003 and 0.0018 ppm respectively. For endosulfan, they were 0.007 and 0.0050 ppm; for malathion, they were 20 and 17 ppm, and for dimethoate they were 40 and 45 ppm respectively. The physical reactions of the fish poisoned with these insecticides were studied. The fish exhibited wild swimming, excitation and loss of equilibrium. Ultimately, they sank to the bottom of the water and died.--Copyright 1974, Biological Abstracts, Inc.

W76-07699

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

**TOXICITY BIOASSAYS OF CADMIUM ON SELECTED FRESHWATER INVERTEBRATES AND THE INTERACTION OF CADMIUM AND ZINC ON THE FRESHWATER SHRIMP, PARATYA TASMANIENSIS RIEK,**  
Adelaide Univ. (Australia). Dept. of Zoology.  
V. J. Thorp, and P. S. Lake.  
*Aust J Mar Freshwater Res.* 25(1), p 97-104, 1974.

Descriptors: \*Bioassay, \*Toxicity, Invertebrates, Freshwater fish, Resistance, Seasonal, \*Cadmium, \*Sulfates, \*Shrimp, \*Australia.  
Identifiers: Atalophlebia-Australis, Austrochiltonia-Subtenius, Ischnura-Heterosticta, Lepoceridae, Paratya-Tasmaniensis, Shrimp, Tasmania.

In acute toxicity bioassays with cadmium sulfate at 15 degrees C in soft water (total hardness 10 mg/l as calcium carbonate), the concentrations fatal to 50% of the test animals were determined for 5 freshwater invertebrate species. The 96 h median lethal concentration (LC50) of Cd was 0.04 mg/l for the amphipod Austrochiltonia subtenius Sayce, 0.06 mg/l for the shrimp Paratya tasmaniensis Riek, 0.84 mg/l for the ephemeropteran nymph Atalophlebia australis Walker, 250 mg/l for the zygoteran nymph Ischnura heterosticta (Burmeister) and well over 2000 mg/l for a trichopteran larva of the Leptoceridae. The bioassays on Paratya indicated that there may be seasonal differences in sensitivity to Cd. The 96 h LC50 for Xn for Paratya was 1.21 mg/l. Zn and Cd appeared to interact less than additively at concentrations below 1 toxic unit. Above this concentration, their interaction was strictly additive.—Copyright 1974, Biological Abstracts, Inc.  
W76-07700

**POLLUTION OF A TASMANIAN RIVER BY MINE EFFLUENTS: I. CHEMICAL EVIDENCE,**  
Tasmania Univ., Hobart (Australia). Dept. of Botany.  
For primary bibliographic entry see Field 5B.  
W76-07704

**POLLUTION OF A TASMANIAN RIVER BY MINE EFFLUENTS: II. DISTRIBUTION OF MACROINVERTEBRATES,**  
Tasmania Univ., Hobart (Australia). Dept. of Zoology.  
For primary bibliographic entry see Field 5B.  
W76-07705

**ULTRASTRUCTURAL CHANGES INDUCED BY LOW CONCENTRATIONS OF DDT IN THE LIVERS OF THE ZEBRAFISH AND THE GUPPY,**  
New Jersey School of Medicine, Newark. Dept. of Anatomy.  
P. Weis.  
*Chem-Biol Interactions.* 8(1), p 25-30, 1974.

Descriptors: \*Fish, \*DDT, Effects, Insecticides, Pesticides, \*Fish diseases, Fish physiology, \*Resistance, Pollutants, Toxins, \*Water pollution effects.  
Identifiers: Brachydanio-Rerio, Guppies, Livers, Poecilia-Reticulata, Tolerance, \*Zebrafish.

Following exposure to 0.3-3.0 ppb DDT, the livers of zebrafish (Brachydanio rerio) and guppies (Poecilia reticulata) were examined by electron microscopy. After 24 h in 1.0 ppb or 72 h in 0.3 ppb, zebrafish had a complete loss of glycogen, decrease in cell size and a cytoplasmic compartment filled with rough endoplasmic reticulum (ER). Guppies exposed for periods of up to 28 days showed only a gradual accumulation of smooth ER and no change in glycogen, lipid, rough ER or cell size. The relationship of these changes to the zebrafish's sensitivity and the guppy's tolerance to DDT is discussed.—Copyright 1974, Biological Abstracts, Inc.  
W76-07706

**STUDIES OF TOLERANCE TO HEAVY METALS IN THE FLORA OF THE RIVERS YSTWYTH AND CLARACH, WALES,**  
University Coll. of Wales, Aberystwyth. Dept. of Botany and Microbiology.  
R. O. McLean, and A. K. Jones.  
*Freshwater Biology.* Vol. 5, p. 431-444, 1975. 6 fig., 8 tab., 31 ref.

Descriptors: \*Algae, Water pollution effects, \*Heavy metals, \*Bioindicators, Lead, Iron, Zinc, Copper, Manganese, \*Absorption, \*Diatoms, \*Chlorophytes, \*Resistance, Zinc radioisotopes, Tracers, Water quality control, Environmental effects, Laboratory tests, On-site investigations, Rivers, Analytical techniques, Plant populations.  
Identifiers: \*River Ystwyth(Wales), \*River Clarach(Wales), Bioaccumulation, Hormidium spp, Scapania, Fontinalis.

A survey of the river Ystwyth demonstrated metal pollution, especially below old lead miles. Hormidium spp. were the most tolerant filamentous green algae. Scapania undulata was a tolerant bryophyte in the Ystwyth and Clarach rivers. It was found alone in polluted sites and less frequently in cleaner areas. Metal extracts of *S. undulata* showed variation in metal concentrations of the environment to some extent. Lower levels of Fe, Pb and Mn were found in Scapania than in the less tolerant *Fontinalis squamosa*, which died 18 weeks after transplantation to polluted sites. Zn 65 tracing experiments showed that both plants had similar uptake patterns for the metal, but that the amount taken up was slightly higher in the less tolerant *Fontinalis*. Diatom flora varied according to degree of pollution in an area. (Katz)  
W76-07712

**FLUORESCENT WHITENING AGENTS: ACUTE FISH TOXICITY AND ACCUMULATION STUDIES,**  
Procter and Gamble Co., Cincinnati, Ohio. Environmental Water Quality Research Dept.  
R. N. Sturm, K. E. Williams, and K. S. Macek.  
*Water Research.* Vol. 9, No. 2, p. 211-219, February, 1975. 5 fig., 4 tab., 4 ref.

Descriptors: Laboratory tests, \*Sunfishes, \*Channel catfish, \*Bioassay, \*Toxicity, Water pollution sources, \*Detergents, \*Anions, \*Absorption, Organic compounds, Methodology, Analytical techniques, Pollutant identification.  
Identifiers: Bioaccumulation, \*Fluorescent whitening agents, Tissue analysis.

Four fluorescent whitening agents (FWA) were tested to determine their acute toxicity to the bluegill (*Lepomis macrochirus*) as well as their potential for accumulation in the flesh of the bluegill and channel catfish (*Ictalurus punctatus*). Results of acute toxicity bioassays showed no acutely toxic effects on fish at levels well above projected environmental levels. Rates and maximum levels of accumulation were evaluated in the laboratory for 90-105 days, followed by 28-day examination of the rate of elimination. Neither species accumulated any of three anionic fluorescent whitening agents when exposed to concentrations of 0.125, 1.25 or 12.5 micrograms/liter. A nonionic FWA not currently used in U.S. detergents was accumulated at the two highest concentrations and was completely eliminated by fish after 14 days in water devoid of the chemical. No significant accumulation of any FWA by fish was observed at levels approximating projected environmental concentrations. (Katz)  
W76-07713

**TEMPERATURE SELECTION IN BROOK TROUT (SALVELINUS FONTINALIS) FOLLOWING EXPOSURE TO DDT, PCB OR PHENOL,**  
University of Western Ontario, London. Dept. of Zoology.  
D. L. Miller, and D. M. Ogilvie.

Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 5, p. 545-551, 1975. 4 fig., 10 ref.

Descriptors: \*Pesticides, Water pollution effects, \*Temperature, \*DDT, \*Polychlorinated biphenyls, \*Brook trout, Environmental effects, \*Toxicity, \*Phenols, Lethal limit, Mortality, Fish behavior, Thermocline, Trout, Toxicants, Chlorinated hydrocarbon pesticides.

Identifiers: Sublethal effects.

Brook trout were exposed for 24 hours to DDT (10 to 50 ppb), phenol (0.75 to 10 ppm), or PCB (25 to 100 ppm). Following this exposure, the fish were placed in temperature gradient apparatus in order to determine the effect of these pesticides on temperature selection. Fish exposed to the lowest dose of DDT (10 ppb) selected lower temperatures than control fish, whereas the highest dose (50 ppb) increased the selected temperature. The 24 hour LD50 was estimated at 54 ppb. Exposure to phenol produced a downward shift in selected temperature. The 24 hour LD50 was estimated at 11.7 ppm for phenol. No level of PCB tested had an effect on selected temperatures of brook trout. Despite the chemical similarity of DDT and PCB, it appears that PCB is less toxic than DDT and does not alter the thermoregulatory behavior of fish as does DDT. (Katz)  
W76-07714

**DECHLORINATION OF MUNICIPAL SEWAGE USING SULFUR DIOXIDE,**  
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).  
D. W. Martens, and J. A. Servizi.  
*Progress Report No. 32*, 1975. 24 p., 1 fig., 8 tab., 26 ref.

Descriptors: \*Bioassay, \*Toxicity, Municipal wastes, \*Chlorination, Sewage treatment, Quality control, \*Sulfur compounds, \*Mortality, \*Pink salmon, \*Sockeye salmon, Sewage lagoons, Laboratory tests, Analytical techniques, Lethal limit, Dissolved oxygen, Hydrogen ion concentration, Methodology, Disinfection, Water treatment, Water purification.  
Identifiers: \*Dechlorination, Sulfur dioxide, *Oncorhynchus nerka*.

Simultaneous continuous flow bioassays of primary treated, chlorinated and dechlorinated municipal sewage were conducted with sockeye and pink salmon to evaluate the effectiveness of sulfur dioxide on removal of chlorine and chlorine induced toxicity. Chlorination decreased the average Mean Survival Time (MST) of sockeye in undiluted primary treated sewage from 293 minutes to 32 minutes. Dechlorination increased the average MST to 434 minutes indicating that all the chlorine induced toxicity and some primary sewage toxicity was removed. However, sewage which had received primary treatment remained acutely toxic to sockeye and pink salmon following chlorination-dechlorination. Dissolved oxygen and pH were not adversely affected by sulfur dioxide. The cost of dechlorination using sulfur dioxide is discussed. Lagooning is recommended as an alternative to chemical dechlorination where flows are small and land requirements not great. (Katz)  
W76-07715

**THE EFFECTS OF WATER-SOLUBLE PETROLEUM COMPONENTS ON THE GROWTH OF CHLORELLA VULGARIS BEIJERINCK,**  
Toronto Univ. (Ontario). Dept. of Botany.  
P. B. Kauss, and T. C. Hutchinson.  
*Environmental Pollution.* Vol. 9, p 157-174, 1975. 7 fig., 3 tab., 40 ref.

Descriptors: \*Toxicity, \*Chlorella, \*Algae, Oil, \*Oil pollution, \*Bioassay, \*Growth rates, Plant

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

growth, Evaporation, Primary productivity, Water pollution effects, Environmental effects, Food webs, Methodology, Organic compounds, Laboratory tests, Separation techniques, Analytical techniques, Thermodynamics.

Identifiers: Crude oil extracts, \*Chlorella vulgaris, Sublethal effects, Benzene, Toluene, Xylene, Naphthalene.

Laboratory tests showed differences in toxicity of the aqueous extracts of seven different crude oils and one refined product to Chlorella. Reduction in cell numbers varied from 5% to 41%, during the first 48 hours. This toxicity was apparently a short-term lag phase. The observed toxicity of oil extracts is due to highly volatile compounds that were lost by evaporation within 24 hours. A significant stimulation of growth was observed with three of the oil extracts after their toxic compounds had evaporated. It is not known if this reflected an actual ability to utilize certain hydrocarbons heterotrophically from the extract. Other interpretations are discussed. (Katz) W76-07716

#### METHOD FOR ASSESSMENT OF TOXICITY OR EFFICACY OF MIXTURES OF CHEMICALS,

Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.  
L. M. Marking, and V. K. Dawson.  
Investigations in Fish Control, No. 67, United States Department of the Interior, Fish and Wildlife Service, Washington, D.C., 1975. 8 p, 1 fig, 2 tab, 28 ref.

Descriptors: \*Toxicity, \*Pesticides, Assessments, Methodology, Analytical techniques, \*Bioassay, Laboratory tests, \*Zinc, \*Toxicants, \*Rotenone, \*Rainbow trout, \*Mathematical models, Sunfishes, Lethal limit, Mortality, Rhodamine, Copper, Antimycin a.

Identifiers: Synergistic effect, Additive index, Salmo gairdneri, Lepomis macrochirus, Cyanide, MS-222, Malachite green, Dibrom.

The individual toxic contributions of poisons were summed, and the additive toxicity was defined by a linear index for two chemicals in combination. This index expresses the toxicity quantitatively: zero indicates additive toxicity, negative values indicate less than additive toxicity, and positive values indicate greater than additive toxicity. Examples from the literature were selected and tests were conducted in the laboratory to assess the additive toxicity of selected chemical mixtures to fish. The values ranged from -1.37 for zinc and cyanide to 7.20 for malathion and Delnav (R). The method quantifies additive toxicity or efficacy, and assists in evaluating the advantages as well as environmental hazards resulting from chemical mixtures. (Katz) W76-07718

**DDT RESIDUES IN COD LIVERS FROM THE MARITIME PROVINCES OF CANADA,**  
Fisheries and Marine Service, Halifax (Nova Scotia). Inspection Branch.  
G. G. Sims, C. E. Cosham, J. R. Campbell, and M. C. Murray.  
Bulletin of Environmental Contamination and Toxicology, Vol. 14, No. 4, p 505-512, 1975. 1 fig, 4 tab, 16 ref.

Descriptors: \*DDT, \*DDE, \*Pesticide residues, \*Lipids, Commercial fish, \*Path of pollutants, Pesticides, \*Absorption, Analytical techniques, Chlorinated hydrocarbon pesticides, Methodology, Polychlorinated biphenyls, Pollutant identification, Canada.

Identifiers: Gadus morhua, \*Cod, \*Cod liver oil, Tissue analysis.

Residues of DDT and its analogs were estimated in cod liver samples (*Gadus morhua*) collected off the Maritime Provinces of Canada. The residue

levels indicated widespread distribution of DDT over the entire region sampled. Variations in the relative contributions of DDE and DDT to the total DDT residues were noted and preferential accumulation of these residues in lipid rich tissues was noted. Residue levels found in cod livers were compared to residue levels determined in cod flesh taken from some of the same specimens and also to residue levels in commercially refined cod liver oils. Samples of each of these types were analyzed for DDT and PCB simultaneously. Commercial cod liver oil had only 10% (1.9 ppm) the amount of DDT found in cod liver. (Katz) W76-07719

#### CONIFER DAMAGE AND DEATH ASSOCIATED WITH THE USE OF HIGHWAY DE-ICING SALT IN THE LAKE TAHOE BASIN OF CALIFORNIA AND NEVADA,

Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.

R. F. Scharpf, and M. Slago.

In: Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sandia Vagabond Convention Center, South Lake Tahoe, California. Report No. NSF/RA/G-74-012, p 36-61. 2 fig, 5 tab, 11 ref.

Descriptors: \*Salts, \*Highways, \*Highway icing, \*Conifers, Salt tolerance, Coniferous trees, Pine trees, Vegetation effects, Vegetation, Water pollution, Water pollution sources, Pollutants, Soil contamination, Plant physiology, Plant pathology.

Identifiers: \*Highway deicing, \*Lake Tahoe (Nev - Calif).

In the winter of 1972-73 severe damage to conifers was observed along the major state and county highways in the Lake Tahoe Basin. Local foresters suspected highway deicing salt as the cause of damage. A biological evaluation was begun in the spring of 1973 to determine the cause and distribution of damage to the roadside conifers, the species affected, and the relationship of tree damage to the distances of trees from the highways. Estimates from the evaluation indicated that some 3000 trees died or were damaged on more than 300 locations in the basin. Browning of foliage, branch dieback, and in many cases, dead trees of all sizes and ages were observed. Damage and death were greater for trees near highways and less for trees at greater distances from the highways; in some cases damage occurred up to 60 feet from the pavement. Tests in the greenhouse, which involved adding different concentrations of salt solution to potted trees, duplicated symptoms and damage observed in the field. It was concluded that salt applied to the highways is a major cause of damage and death to roadside conifers in the basin. Damage probably will continue to occur if the use of sodium chloride for highway deicing continues at the present level. (See also W76-07793) (Sims - ISWS) W76-07796

#### THE FISH FAUNA IN KANGAWA WATER SYSTEM, (IN JAPANESE),

Tokyo Univ. of Education, Nagano (Japan). Sugadaira Biological Lab.  
H. Ando, and K. Aonuma.  
Bull Sugadaira Biol Lab. 7, p 25-32, 1975.

Descriptors: Fish, Asia, \*Fish populations.

Identifiers: Anguilla-Japonica, Carassius-Langsdorffii, Cobitis-Biwaie, Cottus-Hilgendorfi, Cyprinus-Carpio, \*Japan, Kangawa, Lefua-Echigonia, Liobagrus-Reini, Misgurnus-Anguilla-caudatus, Morocco-Steindachneri-Steindachneri, Oncorhynchus-Keta, Oncorhynchus-Masou-Ishikawai, Plecoglossus-Altilvelis, Pseudorasbora-Parva, Salvelinus-Fontinalis, Salvelinus-Leucomaenae-Pluvius, Tribolodon-Hakonensis-Hakonensis.

A total of 7 families and 17 spp. of fish were previously found in Kangawa Water System of Sanada-

machi, Chisagata-kun, Nagano Prefecture, Japan. About 50 yr ago salmon disappeared from the water, and therefore presently 7 families and 16 spp. of fish live in Kangawa Water System. The 17 spp. are *Oncorhynchus keta*, *Oncorhynchus masoni* f. *ishikawai*, *Salmo gairdneri* f. *iridens*, *Salvelinus leucomaenae* *pluvius*, *Salvelinus fontinalis*, *Plecoglossus altivelis*, *Pseudorasbora parva*, *Tribolodon hakonensis* *hakonensis*, *Syprinus carpio*, *Carassius langsdorffii*, *Misgurnus anguillicaudatus*, *Lefua echigonia*, *Cobitis biwaie*, *Morocco steindachneri* *steindachneri*, *Liobagrus reini*, *Anguilla japonica*, and *Cottus hilgendorfi*. *Liobagrus reini* are becoming rare recently, probably because of water pollution.—Copyright 1975, Biological Abstracts, Inc.

W76-07934

#### PRODUCTION OF SOME MASS CRUSTACEANS OF THE KUIBYSHEV RESERVOIR IN THE REGION OF SVIYAZH BAY, (IN RUSSIAN),

Kazan State Univ. (USSR). Dept. of Vertebrate Zoology.

R. K. Ziganshina, and E. M. Sofronova.  
Biol Nauki 16(12), p 7-11, 1973.

Descriptors: \*Crustaceans, Reservoirs, Bays, Da-phnia, Production.

Identifiers: *Acanthocyclops-Vernalis*, *Bosmina-Coregoni*, *Bosmina-Longirostris*, *Ceriodaphnia-Pulchella*, *Cyclops-Vicinus*, *Daphnia-Cucullata*, *Daphnia-Longispina*, *Diaphanosoma-Brachyrum*, *Eudiaptomus-Gracilis*, *Fecundity*, *Mesocyclops-Leuckarti*, *Moina-Rectirostris*, *Polyphemus-Pediculus*, *Russian-SFSR*, *Scapholeberis-Mucronata*, *Sida-Crystallina*, *Simocephalus-Vetus*, *Span*, *Sviyazh*, \*USSR(Kuibyshev Reservoir).

On the basis of hydrobiological collections and experimental data the production of copepods and mass species of cladocerans of the Sviyazh Bay of the Kuibyzhev Reservoir on the Volga (Russian SFSR, USSR) was calculated. The production of copepods was considerably less than the productions of cladocerans and the production of the crustaceans on the whole was higher during a dry year (1969) than during a wet year (1970). The span of copepods was much greater than that of cladocerans and depended on the species and environmental factors. The fecundity of cladocerans depended mainly on the food supply; the fecundity of copepods depended on the environmental temperature. (*Sida crystallina*, *Diaphanosoma brachyrum*, *Daphnia longispina*, *D. cucullata*, *Sinocephalus vetulus*, *Moina rectirostris*, *Ceriodaphnia pulchella*, *Scapholeberis mucronata*, *Bosmina longirostris*, *B. coregone*, *Polyphemus pediculus*, *Eudiaptomus gracilis*, *Cyclops vicinus*, *Acanthocyclops vernalis* and *Mesocyclops leuckarti* are discussed.)—Copyright 1975, Biological Abstracts, Inc.

W76-07935

#### ECOLOGICAL OBSERVATIONS ON SIMULIIDAE OF THE ARNONE RIVER AND INFLENTS OF THE BRACCIANO LAKE, (IN ITALIAN),

L. Rivescochi, C. Cavallini, M. Nocciolo, and L. Rubeca.  
Riv Parassitol 35(4), p 331-356, 1974.

Descriptors: Organic wastes, Water pollution, Thermal pollution, Europe, Lakes, Rivers, Ecology, Effluents.

Identifiers: Arnone, Boophthora-Erythrocephala, Bracciano, Cladophora, Eusimilium-An-gustitarse, Eusimilium-Aureum, Eusimilium-Cryophilum, Eusimilium-Latigonum, Eusimilium-Latinum, Eusimilium-Latipes, Eusimilium-Latizonum-F-Paludicola, Eusimilium-Rubzovianum, \*Italy, Nostoc, Obuchovia-Brevifilis, Odagmia-Dorieri, Odagmia-Nitidifrons, Odagmia-Ornata, Odagmia-Pontina, Odagmia-Variegata, \*Simuliidae, Simulium-Galeratum, Thelohania, Wilhelmia-Lineata, Wilhelmia-Mediterranea.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

Larvae and pupae were collected from 18 collecting stations in monthly collections. There were 16 spp. (*Eusimulum cryophilum*, *E. angustitarse*, *E. latigonum*, *E. rubzovianum*, *E. latizonum* *F. paludicola*, *Odagnia ornata*, *O. nitidifrons*, *O. pontina*, *O. variegata*, *O. dorieri*, *Obuchovia brevifilis*, *Boophthora erythrocephala*, *Wilhelminia mediterranea*, *W. lineata*, *Simulium galeratum*). In the area studied 4 zones were distinguished. Zones I and II have fairly pure waters. Zone III has strong organic pollution. Zone IV is a recovery zone. In zone I there are streams with fairly rapid waters; most of the larvae (about 70%) stick to debris, especially plastic materials. The most characteristic species of this zone is *O. ornata* (s.l.). The 3 spp. of this group (*O. ornata*, *O. nitidifrons*, *O. pontina*) have 3 distinct filtering-apparatuses. Zone II has little brooks where ornithophilic species of the *E. latipes* and *E. aureum* groups develop; the *E. latipes* group prefers pure water, the *E. aureum* more polluted water. The Arnone River (Italy) has its source in zone III where there is strong autotrophy; rocks are covered by *Cladophora*, *Nostoc*, etc. There are also high temperatures. The characteristic species is *W. mediterranea*. Zone IV has strong variations in level and in temperature. All the larvae cling to non-trailing plants. The most common species are *W. lineata* and *S. galeratum*. Parasitic organisms were also on Simuliidae larvae and adults (1% of the hosts for Microsporidia of the group Thelohania). For 10 spp. zonal and seasonal distributions are given. Some autoecological data on 14 spp. are summarized.—Copyright 1975, Biological Abstracts, Inc.

W76-07936

**PRODUCTION OF A SEMI-VOLTINE CHIRONOMID, CHIRONOMUS COMMUTATUS STR., IN LAKE PORT-BIELH (CENTRAL PYRENEES), (IN FRENCH),**  
Toulouse-3 Univ. (France). Laboratoire d'Hydrobiologie.  
For primary bibliographic entry see Field 2H.

W76-07939

**BRIEF MICROBIOLOGICAL CHARACTERIZATION OF THE KAYRAKKUM RESERVOIR, (IN RUSSIAN),**  
Akademiya Nauk Tadzhikskoi SSR, Dushanbe. Institut Zoologii i Parazitologii.  
N. I. Bogdanov.

Izv Akad Nauk Tadzh Ssr Ost Biol Nauk. 3, p 34-36, 1973.

Descriptors: Bacteria, \*Phytoplankton, Primary productivity, Reservoirs, Microorganisms, \*Decomposing organic matter, \*Photosynthesis, Biomass, Eutrophication, Oligotrophy.  
Identifiers: Tadzhik-SSR, USSR.

The Kayrakkum Reservoir (USSR) was studied to determine the rate of photosynthesis of phytoplankton, its abundance and biomass; the rate of breakdown of organic matter and dynamics of the abundance of bacterioplankton; and abundance of microorganisms in the bottom deposits of the Reservoir depending on their chemical composition. The reservoir is oligotrophic with respect to the rate of photosynthesis of phytoplankton. The breakdown of organic matter exceeds primary production by a factor of 2-3, which indicates a high activity of bacterioplankton. A study of the chemical composition and microflora of the bottom deposits established the role of bacteria as a food source of the benthic invertebrates and revealed a direct relationship between the paucity of the benthos and the microflora of the bottom deposits of the Reservoir. The Kayrakkum Reservoir is located on the Syr-Darya River in the Tadzhik SSR and has an area of 513 km<sup>2</sup>, volume of 4.2 km<sup>3</sup> and average depth of 8.1 m.—Copyright 1975, Biological Abstracts, Inc.

W76-07941

**PHYTOPLANKTON OF THE VLASINA LAKE DURING THE PERIOD 1949-1964, (IN SERBO-CROATIAN),**  
Institute for Biological Research, Belgrade (Yugoslavia).  
For primary bibliographic entry see Field 2H.  
W76-07942

**A CHARACTERISTIC OF THE LAKES OF THE LECZYNJSKO-WŁODAWSKIE LAKE DISTRICT BASED ON ABIOTIC ENVIRONMENTAL FACTORS, (IN POLISH),**  
Maria Curie-Sklodowska Univ., Lublin (Poland). Inst. of Biology.  
S. Raswan, W. Podgorski, and C. Kowalczyk.  
Ann Univ Mariae Curie-Sklodowska Sect C Biol 29; p 231-246, 1974.

Descriptors: \*Lakes, Europe, Phosphates, Conductivity, Environmental effects, Lime, \*Oxidation, Temperature, \*Organic matter.  
Identifiers: Abiotic conditions, Leczynsko, Poland, Włodawske.

The dependence among some abiotic factors and an attempt to classify the lakes of the Leczynsko-Włodawske Lake district (Poland) are discussed on the basis of previously examined physicochemical factors. There are correlations between the amount of lime and conductivity, phosphate and the organic matter content, temperature and oxidation, and pH and Mg, Fe and NH<sub>3</sub>. Electrolytic conductivity, conditioned by the lime of content and general oxidation, is the main factor defining the properties of the lakes. The remaining coefficients have an indirect or small effect on the differentiation of the lakes. On the basis of numerical values, 15 variants of lake classification were obtained.—Copyright 1975, Biological Abstracts, Inc.

W76-07943

**HYDROBIOLOGICAL CONDITION IN THE RESERVOIR-COOLER OF THE LITHUANIAN STATE REGIONAL ELECTRIC POWER STATION, (IN RUSSIAN),**  
Akademiya Nauk Litovskoi SSR, Vilnius. Institut Zoologii i Parazitologii.  
A. S. Astrauskas, and L. A. Rachyunas.  
Gidrobiol Zh 11(1); p 19-27, 1975.

Descriptors: \*Algae, Biomass, Reservoir, \*Thermal pollution, Zooplankton, Spawning, Fish, Organic matter, Hydroelectric powerplants.  
Identifiers: \*Hydrobiological conditions, Lithuanian SSR, USSR.

With heating a complex interaction system of hydrodynamic factors influencing the formation of washout zones and suspension accumulation was created in the reservoir (USSR). The group complex is under reconstruction. In the heated zone algae and higher water plants vegetate all year round. Zooplankton is less abundant because of evacuation of the organisms into the open part of the water body. After passing through the station cooler the number of organisms and their biomass are reduced by 1/2. The number and biomass of the benthic invertebrates are less with a comparatively greater species diversity (determined by evacuation of organic suspensions and detritus). Divergences in time and duration of spawning in different thermal zones are detected for certain fish species. The spawning for most species in the heated part starts earlier and takes less time.—Copyright 1975, Biological Abstracts, Inc.

W76-07944

**THE PRODUCTIVITY OF THE WATERS OF MAR GRANDE AND MAR PICCOLO OF TARANTO (1962-1969), (IN ITALIAN),**  
For primary bibliographic entry see Field 2L.  
W76-07947

**PARTICULARS OF SOME SPECIMENS OF ALGAL FLORA OF THE PONDS OF BERRE AND VAINNE (BOUCHES-DU-RHONE), (IN FRENCH),**  
Aix-Marseille-2 Univ. (France). Laboratoire de Biologie Vegetale.  
R. Rioual.  
Bull Soc Phycol Fr 19, p 3-16, 1974.

Descriptors: \*Algae, Lakes, Europe, Ponds, Aquatic habitats, \*Salinity, Water pollution, Cytological studies, Organic wastes, Chemical wastes.

Identifiers: Berre, Bouches-du-Rhone, Callithamnion-Corymbosum, Ectocarpus-Confervoidea-var-confervo, Enteromorpha-Prolifera-ssp. Prolifera, \*France, Grateloupia-Filicina, Vaine.

Lakes Berre and Vaine (Bouches-du-Rhone) (France) constitute an aquatic habitat with very specific ecological conditions, especially with regard to salinity, turbidity and pollution. There has been a decrease in the average salinity since 1966 (30-13%), a progressive deposition of silt on the rocky substratum and an increase in the turbidity and pollution (organic and chemical). These changes in environmental conditions led to morphological and cytological changes in some of the algal flora, particularly Grateloupia filicina (Wulfen) O. Agardh, Callithamnion corymbosum (Smith) Lyngbye, Ectocarpus confervoides (Roth) Kjellman var. confervoides, Enteromorpha prolifera (O.F. Muller) J. Agardh ssp. prolifera type I de Bliding.—Copyright 1975, Biological Abstracts, Inc.

W76-07950

**PRELIMINARY NOTE ON THE ALGAL POPULATION OF THE SCIOPHILOUS SURFACE BIOTOPES IN THE EXPOSED MODE, OF THE ISLAND OF LINOSA (STRAIT OF SICILY, ITALY), (IN FRENCH),**  
Naples Zoological Station (Italy). For primary bibliographic entry see Field 2L.

W76-07952

**210PO RADIONACTIVITY IN ORGANS OF SELECTED TUNAS AND OTHER MARINE FISH,**

Scripps Institution of Oceanography, La Jolla, Calif. Soledad Marine Radioactivity Lab.  
F. Hoffman, V. F. Hodge, and T. R. Folsom.  
J. Radiat Res. 15(2), p 103-106, 1974.

Descriptors: \*Fish, \*Marine fish, \*Radioactivity, Radioisotopes, Pollutant identification.

Identifiers: Carangidae, Euthynnus-Lineatus, Euthynnus-Pelamis, Myctoperca-Xenarcha, Polionemus-210, Sarda-Chilensis, Scomber-Japonicus, Scombridae, Seriola-Dorsalis, Seranidae, Thunnus-Alalunga, Thunnus-Albacares, Thunnus-Thynnus, Trachurus-Symmetricus, \*Tunas.

Po-210 radioactivities were measured in organs of 10 spp. of oceanic fish (Thunnus alalunga, T. thynnus, T. albacares, Euthynnus pelamis, E. lineatus, Sarda chilensis, Scomber japonicus, Trachurus symmetricus, Seriola dorsalis and Myctoperca xenarcha) from 3 families (Scombridae, Carangidae and Serranidae). The highest activities were consistently found in the pyloric cecal masses or intestinal contents of the fish.—Copyright 1974, Biological Abstracts, Inc.

W76-07962

**THE PRIMARY PRODUCTIVITY OF MARINE MACROPHYTES FROM A ROCKY INTERTIDAL COMMUNITY,**  
California Univ., Irvine. Dept. of Population and Environmental Biology.

M. M. Littler, and S. N. Murray.  
Mar Biol (Berl). 27(2), p 131-136, 1974.

Descriptors: \*Biological communities, \*Productivity, California, \*Algae, Cyanophyta.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

Identifiers: Colpomenia-Sinuosa, Corallina-Oficinalis-Var-Chilensis, Egregia-Laevigata, Eisenia-Arborea, Gelidium-Pusillum, Gelidium-Robustum, Gigartina-Canaliculata, Halidrys-Dioica, Hydrothrix-Decipiens, Lithothrix-Aspergillum, Macrocystis-Pyrifera, \*Macrophytes, Melobesia-Medioris, Phyllospadix-Torreya, Pseudolithodera-Nigra, Pterocladia-Capillacea, Rhodoglossum-Affine, Sargassum-Agardhianum, Thallus, Ulva-Californica.

This study represents the 1st report of primary production rates for Southern California intertidal producers. The production rates of 18 marine macrophytes near Wilson Cove, San Clemente Island, are close to those for other marine algal communities. (Macrophytes in order of declining productivity on thallus-area basis: Gelidium pusillum, Ulva californica, Sargassum agardhianum, Gigartina canaliculata, Gelidium robustum, Egregia laevigata, Halidrys dioica, Phyllospadix torreyi, Lithothrix aspergillum, Phyllospadix torreyi (with Melobesia mediocris), Pterocladia capillacea, Macrocystis pyrifera, (blue-green algae), Colpomenia sinuosa, Rhodoglossum affine, Eisenia arborea, Corallina officinalis var. chilensis, Hydrothrix decipiens, Pseudolithodera nigra). No apparent relationship was revealed between the productivity of an alga and the division to which it belongs; however, productivity was associated with growth form. Encrusting prostrate forms were the lowest producers in terms of g C/m<sup>2</sup>/h and g C/g dry weight/h; sheet-like and finely-branched forms showed a greater productivity than coarsely-branched forms. G. pusillum and U. californica had considerably greater production rates than the other algae measured.--Copyright 1975, Biological Abstracts, Inc. W76-07965

**SERUM CONSTITUENTS OF THE MALAYSIAN PRAWNS (MACROBRACHIUM ROSENBERGII) AND PINK SHRIMP (PENAEUS MARGINATUS),**  
Hawaii Inst. of Marine Biology, Honolulu.  
G. H. Balazs, S. E. Olbrich, and M. E. Tumbleton. Aquaculture. 3(2), p 147-157, 1974.

Descriptors: \*Shrimp, \*Pink shrimp, Cholesterol, Analysis.  
Identifiers: Dehydrogenase, Glucose, Macrobrachium-Rosenbergii, Malaysia, Penaeus-Marginatus, \*Prawns, \*Serum.

Baseline serum values of newly captured M. rosenbergii and P. marginatus were determined by sequential multiple autoanalysis. Both species have considerable potential for commercial captive culture. Sex differences in serum constituent levels were found within species. Female pink shrimp had higher serum glucose levels than the males. Malaysian prawn males had higher cholesterol levels than females, and the latter had higher levels or activities of urea nitrogen, creatinine and lactic dehydrogenase. Pink shrimp held under laboratory conditions for 10 days had higher levels or activities of serum glucose and alkaline phosphatase and lower levels or activities of serum inorganic phosphorus, total protein, lactic dehydrogenase and glutamic-oxalo-acetic transaminase than pink shrimp sampled immediately after capture.--Copyright 1975, Biological Abstracts, Inc. W76-07966

**LOBSTER NUTRITION: EFFECT ON HOMARUS AMERICANUS OF DIETARY PROTEIN LEVELS,**  
Fisheries and Marine Service, Halifax (Nova Scotia). Halifax Lab.; Fisheries and Marine Service, Halifax (Nova Scotia). Dept. of Environment.  
J. D. Castell, and S. D. Budson. J Fish Board Can. 31(8), p 1363-1370, 1974.

Descriptors: \*Lobsters, \*Proteins, \*Diets, \*Biology, \*Fish diets.

Identifiers: \*Cornstarch.

Adult American lobsters (*H. americanus*) were fed artificial diets ranging between 0-60% protein and made isocaloric by adjusting the content of cornstarch. Those fed the highest level of protein were in the best condition; each decrease in protein resulted in a poorer condition of the lobsters. When lobsters were fed diets at the maintenance level of 0.5% of the body weight in food per day, decreasing the dietary protein content resulted in increasing weight loss and decreasing molt incidence, serum protein content, percent edible meat, heart weight, hepatopancreas and gonad weights and increased moisture content of several tissues. Although the serum glucose level was dependent upon the cornstarch content of the hepatopancreas was not affected by dietary starch levels. The glycogen content of the hepatopancreas showed a very large range of values when protein was omitted from the diet. A relationship between serum Ca level and molt cycle was demonstrated. Serum calcium values went from an average of 50 mg% after molting to over 70 mg% 1 mo. before molting.--Copyright 1975, Biological Abstracts, Inc. W76-07969

#### PHYTOPLANKTON OF THE TAMPA BAY SYSTEM, FLORIDA,

Texas A and M Univ., College Station. Dept. of Oceanography.

J. T. Turner, and T. L. Hopkins.

Bull Mar Sci. 24(1), p 101-121, 1974.

Descriptors: \*Florida, \*Bays, \*Phytoplankton, Plankton, Sampling, Analysis, Estuarine environments, Nutrients, Plant growth, Nitrogen, Phosphorus, Diatoms.

Identifiers: Ceratium-Hircus, Dinoflagellates, Gonyaulax-Balechii, Skeletonema-Costatum, \*Tampa Bay(Fla), Phaeo.

Phytoplankton, nutrients and physical factors in the Tampa Bay System were studied by collections taken quarterly from fall 1969, to early summer 1971. Forty-two diatom and 23 dinoflagellate taxa were recorded from sample aliquots. Annual averages of phytoplankton abundance (0.78 to 1.45 x 10 to the 6th cells/l) were intermediate in comparison with other estuaries of Florida and the northwestern Atlantic. Nitrate (2.31 microg-at/l), phosphate (29.16 microgram-at/l) and chlorophyll + pheophytin (16.43 mg/m<sup>3</sup>) were higher than averages for these regions. The principal diatom was Skeletonema costatum, as in other Gulf and east-coast estuaries. The most abundant dinoflagellates were Gonyaulax balechii and Ceratium hircus. Seasonal trends for nutrients varied from area to area in the bay complex and, on the basis of quarterly surveys, were difficult to interpret. Phytoplankton abundance in 1969-1970 was greatest in fall and least in spring in most sections of the bay. Patterns in 1970-1971 were more variable. Regionally, phytoplankton abundance and nutrient levels generally decreased with increasing salinity toward the mouth of the bay in all seasons. Low N : P ratios throughout the year suggest that N is more limiting than P in the Tampa Bay system.--Copyright 1975, Biological Abstracts, Inc. W76-07973

**THE GRADIENT OF SALINITY, ITS SEASONAL MOVEMENT, AND ECOLOGICAL IMPLICATIONS FOR THE LAKE IZABAL-RIO DULCE ECOSYSTEM, GUATEMALA,**  
Florida Univ., Gainesville. Dept. of Botany.  
M. M. Brinson, L. G. Brinson, and A. E. Lugo. Bull Mar Sci. 24(3), p 533-544, 1974.

Descriptors: \*Lakes, \*Salinity, \*Seasonal, \*Ecosystems, \*Central America, Bays, Conductivity, Profiles, Water temperature, Primary productivity.

Identifiers: \*Guatemala, Lake Izabal, Rhizophora-Mangle, Rio-Dulce, Amatique Bay.

Profiles of conductivity and temperature were measured along a transect of 42 km along the Rio Dulce from Lake Izabal to Amatique Bay, in the coastal lowlands of Guatemala, Central America. Readings were taken 3 times during the dry season between March 22-June 13, 1972. Water conductivity along the transect increased as the dry season progressed. Tides, winds, gravitation forces, a low topographic gradient and low discharge of fresh water at this time of the year are the factors responsible for the upstream movement of high conductivity water. The vertical and horizontal stratification of brackish water disappears with the onset of the wet season. Marine invasions into the lake, and the presence of mature red mangroves (*Rhizophora mangle*) along the Rio Dulce, are explained in terms of the seasonal appearance of this high conductivity water in the area. Pulses of primary production in the bays and coves surrounding the lake and the consequent availability of concentrated food sources coincident with the occurrence of seasonal oligohaline waters inside the lake, are discussed as the casual factors for marine invasions in tropical lakes.--Copyright 1975, Biological Abstracts, Inc. Copyright 1975, Biological Abstracts, Inc. W76-07975

**EFFECT OF A SUBLETHAL CONCENTRATION OF PHENOL ON SOME BLOOD PLASMA ENZYME ACTIVITIES IN THE PIKE (ESOX LUCIUS L.) IN BRACKISH WATER,**  
Helsinki Univ. (Finland). Dept. of Zoology.  
R. Kristoffersson, S. Broberg, and A. Oikari. Ann Zool Fenn. 11(3), p 220-223, 1974.

Descriptors: Fish, \*Pikes, \*Phenols, Effects, \*Water pollution effects, \*Brackish water, Enzymes.

Identifiers: Blood plasma, Cholinesterase, Esox-Lucius, Lactate, Dehydrogenase, Oxalacetate, Glutamate, Pyruvate, Sublethal doses, Transaminase.

In pike kept for 8 days in brackish water (about 6% S) containing about 5 ppm phenol at 10°C, the activities of the plasma enzymes lactate dehydrogenase, glutamate-oxaloacetate transaminase, and glutamate-pyruvate transaminase were significantly elevated. The activity of cholinesterase remained unchanged.--Copyright 1975, Biological Abstracts, Inc. W76-07977

**HEAVY METALS AS TRACE CONSTITUENTS IN NATURAL GROUNDWATERS AND POLLUTED,**  
Kiel Univ. (West Germany). Geologisch-Palaeontologisches Institut und Museum.  
For primary bibliographic entry see Field 5A. W76-07978

**PREPARATION OF ALGAE FOR THE GAS CHROMATOGRAPHIC DETERMINATION OF LINDANE, (IN GERMAN),**  
Hamburg Univ. (West Germany). Institut fuer Hydrobiologie and Fischereiwissenschaft.  
For primary bibliographic entry see Field 5A. W76-07979

**THE MERCURY CONTENTS OF FISH FROM CARINTHIAN LAKES, (IN GERMAN),**  
Bundesanstalt fuer Virusseuchenbekämpfung der Haustiere, Vienna (Austria).  
W. Krocza, P. Glantschnig, and W. Stoeckl. Wien Tierarztl Monatsschr. 61(6/7), p 169-178, 1974.

Descriptors: \*Mercury, \*Fish, Lakes, Pikes, Perches, Analysis, Pollutants, Effects, Water pollution effects, Pollutant identification.

Identifiers: \*Austria(Carinthian Lakes), Muscle, Tissue.

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Effects Of Pollution—Group 5C

Samples of fish (136) and 9 Carinthian lakes (Austria) were analyzed for total Hg in muscle-tissue. After radioactivation of the samples by thermal neutrons followed by chemical separation the amounts of Hg were estimated by gamma-spectroscopy. Calculations of concentrations were based on the fresh-weight of the tissue. Of 62 cyprinides, none showed values over 0.25 ppm Hg. Of 68 pikes and perches, 4 pikes contained more than 0.5 ppm Hg. Six trout, taken from 1 lake, yielded an average concentration of 0.08 ppm Hg in muscle. The lakes in question are probably contaminated by airborne Hg. In small lake focal contamination by an unknown source was assumed.—Copyright 1975, Biological Abstracts, Inc. W76-07981

#### MERCURY IN SOME MARINE ORGANISMS FROM THE OSLOFJORD, Oslo Univ. (Norway). Dept. of Marine Zoology. A. T. Andersen and B. B. Neelakantan. Norv J Zool. 22(3), p 231-235, 1974.

Descriptors: \*Mercury, \*Mollusks, \*Crustaceans, \*Fish, \*Fjords, Geographical regions, Water pollution effects, Aquatic life, Marine animals, Pollutants, Analysis.  
Identifiers: Buccinum-Undatum, Carcinus-Maenas, Cardium-Edule, Clupea-Harengus, Crangon-Crangon, Cyprina-Icelandica, Gadus-Morhua, Modiolus-Modiolus, Mya-Arenaria, Mytilus-Edulis, \*Norway, Oslo, Pandanus-Borealis, Pasiphaea-Multidentata, Platichthys-Flesus, Sprattus-Sprattus.

The concentration of Hg was measured in 6 species of mollusks: Mytilus edulis, Cardium edule, Cyprina icelandica, Mya arenaria, Modiolus modiolus, Buccinum undatum; in 4 species of crustaceans: Carcinus maenus, Pandanus borealis, Crangon crangon, Pasiphaea multidentata; and 4 species of fish: Clupea harengus, Sprattus sprattus, Platichthys flesus, Gadus morhua from the Oslofjord (Norway). The levels of Hg ranged from 0.29-0.84 microg/g dry weight (dw) for mollusks, 0.31-0.39 microg g/dw for crustaceans, and 0.14-0.71 microg g/dw for fish. M. edulis was used to study the geographical variation of Hg within the fjord. There was a higher concentration of Hg in the outer fjord. Analyses of various tissues in M. edulis revealed the highest Hg concentrations in the gills. The mean value of Hg in all the species studied was low compared with results from other areas.—Copyright 1975, Biological Abstracts, Inc. W76-07982

#### PESTICIDE POLLUTION AND ITS ECOLOGICAL IMPLICATIONS, (IN FRENCH), Paris-11 Univ., Orsay (France). Laboratoire de Zoologie. F. Ramade. Bull Soc Zool Fr. 99(1), p 19-25, 1974.

Descriptors: \*Pesticides, Pollutants, Water pollution effects, Biomass, Ecology, Toxicity, Path pollutants.

Pesticide pollution occurs on a worldwide scale. Pesticides are found not only in field areas directly exposed to application, but also in soil, air and water from remote areas. Like radioactive fallout, these compounds circulate between different regions of the biosphere and are concentrated in the biomass all along trophic chains. Biological effects must be considered at each organization level, not only at cellular, organic and individual ones but also at those of populations and communities. Because man stands at the top of the ecological pyramid he can be exposed to accumulated concentrations of toxic contaminants.—Copyright 1975, Biological Abstracts, Inc. W76-07983

#### ALGAL FLORA OF UPPER ISTISU HOT SPRINGS, (IN RUSSIAN) Leningrad State Univ. (USSR).

N. B. Balashova.  
Vestn Leningr Univ Biol 1, p 35-39, 1975.

Descriptors: \*Hot springs, \*Cyanophyta, Algae, Aquatic plants, Saline water, Water temperature, Effluents, Diatoms, Reservoirs.  
Identifiers: Azerbaijan-SSR, \*Bacillariophyta, \*USSR(Upper Istisu).

In the hot springs of Upper Istisu (Azerbaijan SSR (USSR)) 16 spp. of Cyanophyta and 14 of Bacillariophyta were determined. The majority of blue-green algae developed in springs with temperatures of 25-47 C. Diatom species were found only in the effluent stream of 1 hot spring at 25C. All the blue-green algae and some diatoms have a characteristic feature—the development in thermal springs. Many of these species are frequently found in saline reservoirs.—Copyright 1975, Biological Abstracts, Inc. W76-07985

#### STUDIES OF PARAGONIMUS OHIRAI MIYAZAKI: 1939 AND P. SADOENSIS MIYAZAKI ET AL. 1968 FOUND IN NOTO PENINSULA, ISHIKAWA PREFECTURE: JAPAN (IN JAPANESE), Kyushu Univ., Fukuoka (Japan). Lab. of Medical Zoology; and Kyushu Univ., Fukuoka (Japan). School of Health Science. K. Kawashima, M. Miyahara, I. Tada, Y. Sakaguchi, and Y. Hashiguchi. Jpn J Parasitol 24(1); p 24-33, 1975.

Descriptors: Crabs, Fish diseases, Shellfish, Snails, Molluscidae.  
Identifiers: Angustassiminea-Parasitologica, \*Japan(Noto Peninsula), Oncomelanina-Minima, Paragonimus-Ohirai, Paragonimus-Sadoensis, Potamon-Dehaani, Sesarma-Dehaani.

In Noto Peninsula, Ishikawa Prefecture, Japan, 349 brackish water crabs (*Sesarma dehaani*) and 280 fresh water crabs (*Potamon dehaani*) were investigated for *Paragonimus* infection. The metacercariae found in *S. dehaani* were *P. ohirai*. Adults obtained from albino rats experimentally infected with the larvae were *P. ohirai*. Field and experimental studies on the snails showed that *Angustassiminea parasitologica* can serve as the snail host of this fluke. The metacercariae found in *P. dehaani* were similar to those of *P. ohirai*, but the former were more spherical in shape than the latter. Pinkish granules were hardly visible in the larvae found in *P. dehaani*, while in *P. ohirai* the larvae contained numerous pinkish granules. The metacercariae found in *P. dehaani* were *P. sadoensis*. Adults obtained from experimentally infected rats were *P. sadoensis*. Field and experimental studies showed that *Oncomelanina minima* can be the snail host of this fluke. The 2 spp. *Paragonimus* show different host preferences in natural conditions, although their morphological features are similar. The interspecific relations between *P. ohirai* and *P. sadoensis* are briefly discussed.—Copyright 1975, Biological Abstracts, Inc. W76-07991

#### PHENOLOGY AND PRODUCTIVITY OF PISTIA STRATIOTES L. ON THE VOLTA LAKE, GHANA, Ghana Univ., Legon. Dept. of Botany. J. B. Hall, and D. U. U. Okali. J Appl Ecol. 11(2), p 709-725, 1974.

Descriptors: \*Productivity, Africa, Lakes, Nutrients, Plant physiology, \*Phenology, Plant growth, Seasonal, Viruses, Epidemiology.  
Identifiers: \*Ghana(Volta Lake), \*Pistia-Stratiotes.

Floating enclosures were established in continuous *P. stratiotes* L. mats on the Pawpawarm arm which forms the southern-most tip of the man-made Volta Lake in Ghana. At 4-wk intervals from July 1971 to July 1972, *Pistia* samples were

removed from the enclosures for subsequent assessment of biomass, density, plant size, community leaf area, flowering and leaf color. Growth rates, leaf area indices and productivity were calculated from these data. Concurrently water samples were taken for measurement of conductivity and pH. From Sept. to Dec. biomass and relative growth rate remained fairly constant, while flowering increased; from Dec. to Feb. biomass and growth rate fell drastically to about 300 g/m<sup>2</sup> and -0.05 g/g/week respectively, and leaf yellowness was high; in March and April, the relative growth rate reached its maximum of 0.14 g/g/week, and the abundant vegetative reproduction of young rosettes resulted in high plant density and a low percentage of yellowed leaves; from May to Aug., biomass and relative growth rate declined slowly. Results are discussed in relation to earlier data on Volta Lake water composition, and possible seasonal variation in nutrient supply. Seasonal fluctuations in *Pistia* are possibly determined by variations in nutrient enrichment of the lake water by inflow from adjacent land, rather than by the incidence of epidemic virus disease as has been previously suggested. The estimated maximum productivity of *Pistia* on the Volta Lake, about 14.2 g/m<sup>2</sup>/day, is comparable with figures found for the plant elsewhere.—Copyright 1975, Biological Abstracts, Inc. W76-08036

#### NEKTON POPULATION DYNAMICS IN THE ALBEMARLE SOUND AND NEUSE RIVER ESTUARIES,

North Carolina Univ., Raleigh. Dept. of Zoology.  
J. M. Hester, and B. J. Copeland.

Available from the National Technical Information Service, Springfield, Va 22161, as COM-75-10480, \$6.00 in paper copy, \$2.25 in microfiche. UNC-SG-75-02, January 1975. 131 p. 26 fig., 4 tab., 45 ref., 1 append. NOAA 03-3-158-40.

Descriptors: \*Fish populations, \*Animal groupings, \*Distribution, \*Estuaries, \*North Carolina, Varieties, Saline water-freshwater interfaces, Shellfish, Biomass, Spawning, Fish migration, Juvenile growth stage, Fisheries.  
Identifiers: \*Species diversity, \*Albemarle Sound(NC), \*Neuse River(NC), Pamlico Sound(NC).

Albemarle Sound, North Carolina, an oligohaline estuary, is dominated by eight fish species. Three populations and two areas were identified. The indigenous population was associated with freshwater. Populations increase in winter due to emigration of the other populations. The migratory population emigrate to mesohaline waters in spring and remain until fall. Anadromous populations migrate through the estuary to tributaries. Young-of-the-year fish entered the sound in summer; most emigrated by late fall. Immigration coincided with increased estuarine peak primary productivity in spring and summer. All populations used the sound as a nursery. Juveniles fed on zooplankton and organic debris. Species diversity indices were low, indicating severe estuarine stress. The Neuse River estuary, a mesohaline system, was dominated by four fish species. The only important population was migratory producing pronounced seasonal fluctuations. Spring immigration increased concomitantly with chlorophyll-a readings when it functioned as a nursery area. Low summer oxygen probably encouraged emigration to Pamlico Sound and prevented energy utilization. Few nektonic organisms remained to take advantage of the energy available. In these two estuaries, few species were dominant and varied seasonally; species diversity values were lower and did not fluctuate like other nearby systems. Twenty-three economically important fish species were found. The economic importance of these estuaries is stressed. (Buchanan-Davidson-Wisconsin).  
W76-08037

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5C—Effects Of Pollution

#### AN EVALUATION OF THE POTENTIAL FOR ECOLOGICAL DAMAGE BY CHRONIC LOW-LEVEL ENVIRONMENTAL POLLUTION BY FLUORIDE.

California Inst. of Tech., Pasadena. Div. of Humanities and Social Sciences.  
E. Groth.

Fluoride, Vol. 8, No. 4, p. 224-240, 1975. 2 tab., 74 ref.

Descriptors: \*Fluorides, \*Environmental effects, \*Pollutants, Air pollution, Water pollution, Path of pollutants, Soil contamination, Wildlife, Vegetation, Food chains, Toxicity, Insects, Invertebrates, Mammals, Aquatic life, Birds, \*Reviews. Identifiers: \*Biomagnification.

To assess the possible impact of fluoride pollution on natural ecosystems, research on the effects of fluorides on wildlife, plant and animal species is reviewed. Present knowledge is very incomplete, but fluoride meets most, if not all, of the criteria for a pollutant with a major potential ecological impact. Fluoride is a widespread pollutant; it is relatively persistent and is not biodegradable. It is absorbed by a great many organisms and is probably accumulating in food chains even at low levels of exposure. Fluoride possesses high biological activity, with toxic effects on many organisms. The levels of exposure which may occur in the environment appear to be capable of causing adverse effects on some of the wildlife species studied. Information on the potential effects on natural populations and ecological balances is not available. Fluoride may be transformed by some organisms into more toxic organic fluorides; such transformations would have a very serious ecological impact. There are no estimates of safe levels of fluoride for the environment. Research is needed to answer some of these questions and to obtain information for setting standards which will protect ecosystems from damage by fluoride pollution. (Buchanan-Davidson--Wisconsin). W76-08038

#### A STUDY OF THE MARINE RESOURCES OF HINGHAM BAY,

H. R. Iwanowicz, R. D. Anderson, and B. A. Ketschke.

Mass Dep Nat Resour Div Mar Fish Monogr Ser.

14. 1-40. Illus. 1973.

Descriptors: \*Massachusetts, Marine fish, Bays fish populations, Shellfish, Marine algae, Marsh plants, Water pollution, Bacteria, Pesticides, Marine plants.

Identifiers: Hingham Bay(Mass).

An historical review is given of sport and commercial fisheries; geological and morphometric studies; surface water temperature and salinity measurements; pollution studies including bacteriological and pesticide analyses; determinations of type, status, relative abundance and economic value of shellfish and fish populations; an inventory of common algae and vascular marsh plants and studies on the current status of salt marsh acreage and protection carried out along the Massachusetts coast.--Copyright 1975, Biological Abstracts, Inc. W76-08039

#### A SURVEY OF ENVIRONMENTAL FEATURES IN A SECTION OF THE VELLAR-COLERON ESTUARINE SYSTEM, SOUTH INDIA,

Centre of Advanced Study in Marine Biology, Porto Novo (India).

K. Krishnamurthy, and V. Sundararaj.

Mar Biol (Berl). 23(3), p 229-237, 1973.

Descriptors: Estuaries, \*Estuarine environment, Asia, \*Mangroves, Chlorophyll, Phytoplankton, Zooplankton, Surveys, Productivity.

Identifiers: Acrolanmus, Asterionella, Centropages, Coleroon, Corycaeus, Coscinodiscus, Ditylum, Eutermina, \*India, Lucifer, Oikopleura, Oithona, Vellar.

A survey was conducted on Nov. 15th, 1970 in mangrove forests and backwater regions of a section of the Vellar-Coleroon estuarine complex; a total of 19 stations were occupied. Detailed investigations on nutrients, pigments, and plankton were carried out. The following ranges in values were recorded: salinity, 10.40-30.50% parts per thousand; pH, 7.50-8.30; temperature 29.50-30.50 C; total P, 0.72-3.34 microgram at /l; inorganic phosphate, 0.19-1.59 microgram at /l; ammonia, 0.34-0.36 microgram at /l; nitrite, 0.11-0.25 microgram at /l; nitrate, 2.85-6.94 microgram at /l; silicate, 18.49-134.92 microgram at /l; Dissolved O<sub>2</sub> content ranges from 3.69-5.44 ml/l. Chlorophyll a ranged from an undetectable amount to 1.01 mg/m<sup>3</sup>, chlorophyll b and 0.02-0.85 mg/m<sup>3</sup>, chlorophyll c from 0.41 mg/m<sup>3</sup> and carotenoids from 0-0.74 MSPU/m<sup>3</sup> (Millispecific plant pigment unit)/m<sup>3</sup>. The plankton displacement volume ranged from a negligible amount to 3.60 cm<sup>3</sup>/m<sup>3</sup>; seston varied between 0.29-0.91 g/l. Phytoplankton was abundant at 3 stations; at other stations zooplankton was abundant. Coscinodiscus, Asterionella and Ditylum were the dominant forms among the phytoplankton; Oithona, Acrolanmus, Eutermina, Centropages, Corycaeus, Lucifer and Oikopleura were dominant among the zooplankton. Phytoplankton and zooplankton populations, as percentage of the total plankton, varied between 3.70-89.00% and between 11-96.30%, respectively. Average gross production values in the mangrove and back-water stations were 7.56 and 3.33 g C/m<sup>3</sup>/day, and the net production values 6.29 and 2.67 g C/m<sup>3</sup>/day, respectively. Copyright 1975, Biological Abstracts, Inc. W76-08040

#### LONG-TERM CHANGES IN THE PLANKTON OF LAKE TYRIFJORD, NORWAY,

Kongelige Norske Videnskabers Selskab, Trondheim. Museet.

For primary bibliographic entry see Field 2H. W76-08042

#### LABORATORY EFFICACY OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) AS A LAMPRECIIDE,

Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.

V. K. Dawson, K. B. Cumming, and P. A. Gilderhus.

Investigations in Fish Control, No. 63, Department of the Interior, Fish and Wildlife Service, Washington, D.C. 1975. 13 p., 7 tab., 20 ref.

Descriptors: \*Toxicity, \*Pesticides, \*Larval growth stage, Laboratory tests, \*Embryonic growth stage, \*Lampreys, Hydrogen ion concentration, Hardness(Water), Temperature, \*Pesticides, Aquatic animals, Water properties, Lethal limit.

Identifiers: \*Lampreididae, \*TFM, Sea Lamprey, American Brook Lamprey, Petromyzon marinus, Lampetra lamottei.

The lampricidal activity of 3-trifluoromethyl-4-nitrophenol (TFM) was tested under controlled laboratory conditions to evaluate factors which may influence the efficacy of the chemical. TFM was tested at temperatures between 7 and 22 C, total water hardness from 12 to 300 mg/l as CaCO<sub>3</sub> and pH's of 6.5, 7.5, 8.5, and 9.0. TFM is more effective against larvae of the sea lamprey (Petromyzon marinus) than against embryos and polalarval stages. It is more effective against larvae of sea lampreys than against larvae of the American brook lamprey (Lampetra lamottei). Temperature does not influence the efficacy of TFM which decreases in hard water, especially at high pH's. Toxicity of TFM is affected more by pH than any other factor. TFM is significantly more effective against free swimming larvae than against those in burrows. (Katz) W76-08063

#### EFFECTS OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) ON DEVELOPMENTAL STAGES OF THE SEA LAMPREY,

Bureau of Sport Fisheries and Wildlife, Millersburg, Mich. Hammond Bay Biological Station.

G. W. Plavis, and J. H. Howell. Investigations in Fish Control, No. 64, Department of the Interior, Fish and Wildlife Service, Washington, D.C. 1975. 8 p., 3 ref., 1 fig., 1 tab.

Descriptors: \*Piscicides, Pesticides, \*Toxicity, \*Lampreys, Laboratory tests, Immature growth stages, \*Pesticide toxicity, Larvae, Mortality, Hatching, \*Pathology, Fishkill.

Identifiers: \*Sea Lamprey, \*TFM, Hemoglobin, Petromyzon marinus.

Sea lampreys (Petromyzon marinus) at eighteen developmental stages from zygote through larva were exposed for 24 hours to a 10 mg/l (active ingredient) solution of TFM at 18 C. Embryonic development, incidence of abnormalities, and mortality in test animals were compared with unexposed controls. Exposed embryos in the first eight stages showed no immediate effects. However, the number of viable larvae produced was drastically reduced, incidence of abnormalities increased, hatching was delayed and hemoglobin production was inhibited or lacking. These findings suggest that treatment of streams with TFM at the customary rates probably does not effect a complete kill of sea lampreys in all developmental stages. (Katz) W76-08064

#### ACCUMULATION AND LOSS OF RESIDUES OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) IN FISH MUSCLE TISSUE: LABORATORY STUDIES,

Bureau of Sport Fisheries and Wildlife, Warm Springs, Ga. Southeastern Fish Control Lab.

J. B. Sills, and J. L. Allen.

Investigations in Fish Control, No. 65, Department of the Interior, Fish and Wildlife Service, Washington, D.C. 1975. 10 p., 5 tab., 4 ref.

Descriptors: \*Pesticide residues, Pesticides, \*Piscicides, Laboratory tests, \*Bioassay, Water quality control, Hardness(Water), Absorption, \*Gas chromatography, Freshwater fish, Rainbow trout, Channel catfish, Brown trout, Lake trout, White bass, Analytical techniques, Chemical analysis, Hydrogen ion concentration, Carp, Bass, Trout, Sunfishes.

Identifiers: \*TFM, \*Tissue analysis(Fish), \*Bioaccumulation, Morone chrysops.

Residues of 3-trifluoromethyl-4-nitrophenol (TFM) in muscle tissue of eight species of fish, after exposure under controlled conditions, were determined by gas chromatography. The mean concentration of TFM residue in samples from various species immediately after a 12 hour exposure to 1-4 mg/l of TFM ranged from 0.02 to 5.09 micrograms/gram depending on pH, temperature, hardness of test solutions, and TFM concentration. Residues decreased rapidly after the fish were removed from the test media, and were near the limit of detection (0.01 micrograms/gram) within 24 hours. (Katz) W76-08065

#### RESIDUES OF 3-TRIFLUOROMETHYL-4-NITROPHENOL (TFM) IN A STREAM ECOSYSTEM AFTER TREATMENT FOR CONTROL OF SEA LAMPREYS,

Bureau of Sport Fisheries and Wildlife, La Crosse, Wis. Fish Control Lab.

P. A. Gilderhus, J. B. Sills, and J. L. Allen. Investigations in Fish Control, No. 66, Department of the Interior, Fish and Wildlife Service, Washington, D.C. 1975. 7 p., 3 tab., 10 ref.

Descriptors: \*Pesticide residues, Aquatic plants, \*Absorption, Pesticides, Sampling, \*Piscicides, \*Algae, \*Path of pollutants, \*Rainbow trout, Bot-

tom sampling, Water pollution sources, Invertebrates, Lampreys, Water quality control, Fish, Bottom sampling, Pest control, \*Michigan.  
Identifiers: \*TFM, Tissue analysis, Bioaccumulation, \*Lampicides, Au Gres River(Mich).

Samples of water, bottom soil, plants, invertebrates and fish were collected from two stations on the East Au Gres River in Michigan. Collections were made before, during, and after treatment of the stream with 3-trifluoromethyl-4-nitrophenol (TFM) for control of sea lampreys (*Petromyzon marinus*). Residues were highest in samples collected at the last portion of full-strength TFM flowed past each station, and were much higher in water and organisms than in the bottom soil. Fish retained higher residues than other organisms 24 hours after treatment (up to 6 micrograms/gram). Residues decreased to less than 0.08 micrograms/gram at 96 hours after treatment. Residues in soil were among the lowest found in all samples. (Katz)

W76-08066

#### IMPORTANCE OF WATER QUALITY IN THE USE OF LARGE VOLUMES OF WATER FOR CONDENSER COOLING IN POWER STATIONS,

Bhabha Atomic Research Centre, Bombay (India). Chemistry Div.

For primary bibliographic entry see Field 5B.  
W76-08070

A FIELD EVALUATION OF THE EFFECTS OF HEATED DISCHARGES ON FISH DISTRIBUTION,  
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.  
J. R. Stauffer, Jr., K. L. Dickson, and J. Cairns, Jr. Water Resources Bulletin, Vol. 10, No. 5, p 860-876, October 1974. 8 fig, 5 tab, 34 ref.

Descriptors: \*Thermal pollution, \*Heated water, Effects, Fish, Powerplants, Water temperature, Sampling, Evaluation, Water pollution effects.  
Identifiers: Avoidance, Field study, \*Fish distribution.

Studies were conducted to determine the distribution of fish in the New and East Rivers in relation to thermal discharges from Appalachian Power Company's fossil fuel plant at Glen Lyn, Virginia. Over 15,300 specimens representing 41 species were collected with seines, electrogear and rotenone at six sampling locations from February 1973 to October 1973. Sampling frequency was designed to evaluate the effects of ambient temperature upon preferred temperature. Diversity indices were calculated for each location. There was a slight decrease in the diversity indices for those stations located in the thermal discharge. Condition coefficients calculated for *Notropis albus* Jordan, *Notropis rubellus* Agassiz, *Notropis spilopterus* Cope, *Ictalurus punctatus* Rafinesque, and *Etheostoma blennioides* Rafinesque were found to be significantly ( $p=0.05$ ) lower in the thermal discharge for all species except *E. blennioides*. Temperatures were plotted against frequency of capture to determine a particular species temperature selection from field data and indicated that: (1) some species avoided high temperatures (i.e., *Campostoma anomalum* Rafinesque); (2) some species were attracted to high temperatures (i.e., *Ictalurus punctatus*); and (3) some species distribution was not affected by temperatures (i.e., *Notropis spilopterus*). (Bell-Cornell)  
W76-08088

OCCURRENCE AND OUTFLOW OF ZOOPLANKTON IN THE KIEV RESERVOIR, (IN RUSSIAN), Akademiya Nauk URSR, Kiev. Instytut Hidrobiologii. Y. Y. Tseeb, and N. G. Revenko. Gidrobiol Zh. 9(2), p 60-68, 1973.

Descriptors: \*Zooplankton, \*Reservoirs, Biomass, Seasonal, Bacteria, Phytoplankton, Crustaceans, Tributaries.  
Identifiers: Dreissena, Kiev, Rotatoria, \*USSR(Ukrainian-SSR).

The zooplankton biomass increase in the principal Dnieper tributaries (Upper Dnieper, Pripyat' and Teteriv) and its outflow to the tail-water of the Kiev Reservoir (Ukrainian SSR, USSR) was studied in 1971. The main sources of zooplankton are the Upper Dnieper (3581 t/tons), or 87% and the Pripyat' (474 t or 11.6% of the total biomass inflow). The incoming zooplankton was mainly Rotatoria (97% of total biomass). Zooplankton outflow from the reservoir (27,048 t) is 6.5 times larger than inflow, and shows seasonal changes in composition: Cladocera and Dreissena larvae predominate. The seasonal dynamics of gain and outflow in the reservoir are considered. In the total gain, the phytoplankton rate reaches 62%; bacterioplankton, 36%; and zooplankton, 2%. In the reservoir outflow the relative rates are quite different: bacterioplankton, 47%; phytoplankton, 36%; and zooplankton, 17%. This affects plankton formation in the lower reservoirs.--Copyright 1976, Biological Abstracts, Inc.

W76-08090

#### 5D. Waste Treatment Processes

##### REMOVAL OF CESIUM FROM SAVANNAH RIVER PLANT WASTE SUPERNATE,

De Pont de Nemours (E. I.) Co., Aiken, S. C. Savannah River Lab.

J. R. Wiley, and R. M. Wallace.

Available from the National Technical Information Service, Springfield, Va 22161 as DP-1388, \$3.50 in paper copy, \$2.25 in microfiche. DP-1388, July 1975, 19 p, 8 fig, 3 tab, 7 ref. AT(07-2)-1.

Descriptors: \*Water pollution, \*Waste water treatment, Laboratory tests, On-site tests, \*Cesium, Separation techniques, Chemistry, \*Ion exchange.  
Identifiers: Savannah River Plant(SC).

Synthetic and actual wastes were used in a process for separation and concentration of Cs137 from Savannah River Plant waste supernate by the two-column Duolite ion exchange process. In tracer-level studies, Duolite resin efficiently sorbed cesium from a solution with a composition expected for the plant process. The resin can be cycled repeatedly without damage. In column tests using actual waste supernates, greater than 99.99% of the Cs137 was removed. Cs137 from the Duolite columns was sorbed on zeolite for final solidification in concrete or glass. The overall volume reduction factor from cesium-salt solution to cesium-zeolite product is about 1400. Although direct sorption of cesium on zeolite is feasible, it would generate 40 times more cesium-zeolite than would be produced by the Duolite process. (Chilton-ORNL)  
W76-07479

THE ECOLOGICAL BEHAVIOR OF PLUTONIUM AND AMERICIUM IN A FRESHWATER ECOSYSTEM: PHASE II, IMPLICATIONS OF DIFFERENCES IN TRANSURANIC ISOTOPIC RATIOS, Battelle-Pacific Northwest Labs., Richland, Wash.  
For primary bibliographic entry see Field 5C.  
W76-07480

HIGH GRADIENT MAGNETIC SEPARATION, A TECHNOLOGICAL BREAKTHROUGH IN WATER PURIFICATION, Ferman Tanning Co., Boston, Mass.  
L. Riese.

The Leather Manufacturer, Vol. 91, No. 9, p 21-22, 28, September, 1974. 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Separation techniques, Tannery wastes, Magnetic studies, Water purification, Filtration.  
Identifiers: \*Magnetic filtration.

A description of the magnetic filtration techniques for separating water contaminants in tannery effluents is given. The important features of the magnetic filtration process include: the magnetic filter which consists of a filamentary matrix of finely divided ferromagnetic material such as steel wool in a vessel located in the center of a strong electromagnetic field; magnetic seeding by adding finely divided particles of a paramagnetic material and a flocculating electrolyte to form a fluffy coagulant around each contaminating particle; and, the removal of the solids which occurs when the slurry formed by the seeding passes through the magnetized filter and the fluffy mass is magnetically attracted to the steel wool. Backwashing is used to separate the fluffy mass from the steel wool into a separate container. A series of cyclical devices are utilized in a continuous system of filtration and backwashing. The concentrated backwashed material can then be handled more efficiently by conventional methods such as filter pressing. Advantages of this system are a high speed of filtration and a relatively small area required as well as lower capital and operating costs per gallon. (Orr-FIRL)  
W76-07498

ACID STRIP MINE LAKE RECOVERY, Missouri Univ., Columbia. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W76-07499

DISPOSAL OF LIQUID WASTES BY CHEMICAL FIXATION, For primary bibliographic entry see Field 5E.  
W76-07500

OZONE IN DRINKING WATER PREPARATION (OZON IN DER WASSERAUFBEREITUNG), For primary bibliographic entry see Field 5F.  
W76-07501

DEWATERING OF SLUDGES GENERATED IN THE TREATMENT OF WASTE WATERS GENERATED IN REFINERIES (COMPARTOREA LA DESHIDRATARE A NAMOLURILOR PROVENTE DE LA TRATAREA APELOR REZIDUALE DIN RAFINARI), R. Zamfirache, and E. Daciu. Petrol si Gaze, Vol. 25, No. 6, p 328-332, 1974. 5 fig, 1 tab, 8 ref.

Descriptors: \*Sludge treatment, \*Dewatering, \*Industrial wastes, \*Filtration, Coagulation, Design criteria, Equipment, \*Waste treatment.  
Identifiers: \*Refinery residual waters, Calcium oxide, Iron sulfate.

A description of the way sludges react to dewatering by filtration is provided by the means of two parameters, specific resistivity to filtration and the compressibility coefficient. Specific resistivity can be as high as 100 times 10 to the tenth power cm/gram. The dewatering characteristics of these sludges must be improved by treatment with coagulants. Conditioning with mineral coagulants, such as calcium oxide and iron sulfate, reduces the specific resistivity of the sludges down to 10-20 times 10 to the tenth power cm/gram, or 10% of the initial value. Using a mixture of calcium oxide and ferrous sulfate in premeasured quantities is more efficient than using calcium oxide alone. The specific resistivity to filtration and the compressibility coefficient are sufficient criteria for selecting specific equipment to be used for filtration dewatering of the sludges generated in the treatment of refinery residual waters. (Takacs-FIRL)  
W76-07502

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

ECONOMY IN THE TREATMENT AND DISPOSAL OF PICKLING EFFLUENTS (EINSPARUNGEN BEI DER BEHANDLUNG UND BESEITIGUNG VON BEIZEREIABWASSEN),  
G. Woltersdorf.

Metalloberflaeche, Angewandte, Elektrochemie, Vol. 28, No. 5, p 168-169, 1974. 2 ref.

Descriptors: \*Metals, \*Industrial wastes, \*Waste water treatment, Economics, Aeration, Oxidation, Chemical precipitation, Lime, Sludge treatment, Waste disposal.

Identifiers: Pickling shop-generated wastes, Metal surface-treatment.

Possibilities for cost reductions in the treatment and disposal of pickling shop-generated waste waters in the metal surface-treatment industry are described. While small quantities of waste acids are neutralized with sodium hydroxide, this expensive chemical can be replaced by slaked lime when large amounts of waste acids are to be treated. Used iron mordants are aerated until all ferrous hydroxide is transformed into ferric hydroxide. To reduce the aeration tank volume and the aerator capacity, the dilute rinsing water is neutralized in a flow-through process, while the used mordants generated periodically are neutralized in a batch process. The bivalent iron present in the used mordant does not have to be oxidized quantitatively if the precipitation is conducted at high pH values, and the decanted liquid and the filtrate from the sludge separation unit are combined with the rinsing water. The residual amount of ferrous hydroxide is too small to require prolonged aeration, and the slaked lime is utilized completely for the neutralization of the rinsing water. To improve the sludge dewatering, the used mordants are diluted with dilute sludge from the neutralization unit. The sludge precipitated during the subsequent alkalization has high solid content, and is filtered more easily. (Takacs-FIRL)

W76-07503

TANNERY EFFLUENT,  
Canada Packers Ltd., Toronto (Ontario).

J. G. Greifender.

Journal of the American Leather Chemists Association, Vol. 69, No. 10, p 452-459, October, 1974. 35 fig.

Descriptors: \*Tannery wastes, \*Waste water treatment, Separation techniques, Lagoons, Lime, Solids removal, Industrial wastes, Waste disposal.

Effluent processes used at the Beardmore Tannery, Ontario, are described. The first step involves segregation and grouping of the various effluent streams before treatment. The tannery segregates cooling water, salt water, beamhouse effluent, mixed effluent, and 'black water'. The cooling water needs no treatment and is diverted into a small creek. The salt water is screened over a vibrating separator and then pumped to a lagoon. The beamhouse effluent consists of the spent unhairing liquors and rinses. Waste water from the hair-saving limes is screened over a rotating perforated drum to remove long hair and then sent through a settling box to remove heavy suspended solids. Coarse solids are removed by a traveling belt screen and the screened effluent is pumped to a mixing tank. Flue gas treatment is used to remove most of the sulfides from the beamhouse effluent and also to reduce the pH from an average of 12.5 to 8.5. The mixed effluent contains the final effluent from the flue gas treatment in addition to the effluents from bathing, pickling, chrome tanning, coloring, fatliquoring, and finishing. The mixed effluent is treated by primary settling in a mechanical clarifier. The primary sludge is pumped out to a drying facility and the clarified effluent is pumped to an aerated lagoon. The stabilized effluent from the lagoons is sprayed on grassland. The 'black water' stream contains the effluents from the vegetable tannery scrubhouse, currying, and sole leather finishing. It is screened

over a rotating perforated drum and pumped into the same lagoon holding the salt water. The water from this lagoon is disposed of over a field. (Orr-FIRL)

W76-07504

#### ENGINEERING METHODS OF PROCESS SOLUTIONS IN THE TREATMENT OF TANNERY EFFLUENTS.

National Research Inst. for Shoe and Allied Industries, Gottwaldov (Czechoslovakia).

J. Ludvik, K. Jansky, J. Boehm, and S. Siska.

The Journal of the American Leather Chemists Association, Vol. 69, No. 10, p 438-451, October, 1974. 6 fig, 1 tab, 14 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Tannery wastes, \*Biological treatment, Sludge treatment, Mathematical studies, Filtration, Chemical engineering.

Bioengineering and chemical engineering methods used for the solution of some processes involved in tannery effluents purification were studied. Special attention was paid to biological treatment and sludge handling. The discussion of biological treatment contains an analysis of the fundamental processes occurring during the purification by activated sludge, such as substrate decomposition, mixed culture production, and oxygen consumption. Mathematical formulas involved in the individual processes and examples of graphical solutions for the particular case of tannery effluents are given. The sludge handling section provides a methodical analysis of the thickening and filtration processes. The importance of the relation between the sedimentation and thickening rate and the sludge concentration, and of the graphical estimation of the thickening tank loading is explained. An example is given of the primary and secondary sludge flow curves for the tannery effluent. Filtrability is discussed according to the Coackley and Eckenfelder methods, and an example of the technological results of vacuum and pressure filtration of the heat-treated sludge is presented. (Orr-FIRL)

W76-07505

#### RECENT INVESTIGATIONS INTO THE DISPOSAL OF TANNERY WASTE WATER,

Institut TNO voor Leder en Schoenen, Waalwijk (Netherlands).

F. J. Van Vlimmeren, and A. J. J. Van Meer.

The Leather Manufacturer, Vol. 91, No. 8, p 24-29, August, 1974. 7 fig, 11 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Tannery wastes, Chemical wastes, Chemical oxygen demand, Filtration, Sludge, Sulfides, Recycling, Waste disposal.

Identifiers: Unhairing operations, Chromium, Oxidation ditches.

Highlights of the work done on tannery waste water treatment and effluent quality by the Institute for Leather and Shoe Research, TNO, Waalwijk, Holland, and new developments in this area are presented. Reductions in the amount and degree of pollution of the effluent have been accomplished by the introduction of batch washing to replace continuous washing with a lattice door and the introduction of automatic drums and hide processors. Hair-saving unhairing methods are ideal means for the reduction of pollution from the beamhouse but need further refinement to become economically feasible. A new approach to the reduction of the pollution from the beamhouse involves conducting unhairing in the first soaking liquid. This method greatly lowers the COD of the effluent and produces a sludge with good dewatering and filtering properties. The catalytic oxidation of sulfides by aeration after the addition of manganese salt is a viable method for the treatment of sulfide containing effluents. The method for treating chromium containing wastes now under investigation by the Institute is the precipitation of

chromium salts in residual chrome tanning baths followed by filtration and reuse after dissolving the precipitate with acids. The oxidation ditch system is also a solution for the problem of treating tannery waste water at reasonable costs. (Orr-FIRL)

W76-07506

#### CONTROL OF LIQUID EFFLUENTS FROM CHEMICAL/PETROCHEMICAL PLANTS,

Watson (J. D. and D. M.), London (England).

J. M. Sidwick, and D. W. Hayward.

Chemistry and Industry, No. 19, p 756-761, October, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Reviews, Chemical industry, Biological treatment, \*Oil wastes.

Identifiers: Chemical treatment, Physical treatment.

The chemical and petrochemical industries use large volumes of water in their processes for washing down and cooling purposes. The large volume of contaminated waste water produced by these plants varies in pollution impact; the waste streams may be acidic, alkaline, hot, toxic, may contain large volumes of oil or other suspended matter, or may exert a high biochemical or chemical oxygen demand. A categorization and general approaches to principal treatment problems of chemical and petro-chemical wastes are given. An important part of any waste treatment and disposal problem is to try to minimize waste loads at the source by process changes and/or process controls. The possibility of segregating waste streams and of discharging the non-toxic or relatively non-toxic wastes to the environment or to a municipal treatment plant should always be considered. Treatment methods discussed include: physical treatment such as free oil removal, solids separation, and heating, electro-flootation and dissolved air flotation, chemical treatment such as pH control, chemical flocculation, and chemical oxidation; and, biological treatment with suitably conditioned bacteria under aerobic and anaerobic conditions in biological filters, activated sludge systems, or stabilization ponds. Activated carbon treatment, ion exchange methods, dialysis, electrodialysis, electrophoresis, reverse osmosis, and ultrafiltration are also briefly mentioned. It is stressed that every particular problem must be considered individually. (Orr-FIRL)

W76-07507

#### FLAME TREATMENT OF WASTE WATERS CONTAINING ORGANIC CHLORINE AND SULFUR IMPURITIES,

A. P. Shurygin, and M. N. Bernadiner.

International Chemical Engineering, Vol. 14, No. 4, p 618-621, October, 1974. 2 tab, 4 ref. From: Khimicheskaya Promyshlennost, No. 9, p 27-28, 1973.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Chemical industry, Neutralization, Cyclones, \*Sulfur compounds, Sodium compounds, Salts, \*Chlorine.

Identifiers: \*Flame treatment, Hydrogen chloride.

The flame treatment of waste waters containing organic chlorine and sulfur impurities is discussed. Sulfur dioxide and hydrogen chloride are the usual products of combustion of hydrogen chloride and sulfur dioxide and are undesirable for sanitary and corrosive reasons. However, it is thermodynamically possible to add sodium hydroxide to the waste water and produce the non-toxic mineral salts, Na<sub>2</sub>SO<sub>4</sub> and NaCl, from combustion. Experimental investigations were conducted in a laboratory cyclone apparatus to study the feasibility of neutralizing the toxic gaseous products and to determine the optimal parameters for the process. Almost complete combustion of the organic sulfur and chlorine compounds was obtained in the cyclone chamber under the following condi-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

tions: temperature of effluent gases no higher than 990 °C; excess air coefficient between 1.06 and 1.10; specific loadings of the cyclone chamber volume with treated waste water between 0.9 and 1.0 ton/cm<sup>3</sup> m hr; and, spraying quality characterized by an average median drop diameter of 170-280 micrometers. This method for the neutralization of toxic gaseous materials in a high-temperature flame has been utilized in many facilities for the flame treatment of waste waters from chemical plants. (Orr-FIRL)

W76-07508

#### SECONDARY TREATMENT OF WASTE-WATER FROM SYNTHETIC RUBBER PRODUCTION,

Firestone Tire and Rubber Co., Akron, Ohio.

F. G. Troppé.

Rubber Chemistry and Technology, Vol. 47, No. 4, p 932-948, September, 1974. 13 fig, 4 tab, 14 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Neutralization, Coagulation, Flocculation, Biological treatment, Sludge, Costs, \*Sewage treatment.

Identifiers: Synthetic rubber production.

A nine month study was conducted of the treatment of wastes resulting from synthetic rubber production at the Firestone Synthetic Rubber and Latex Company's Lake Charles, Louisiana, plant. The waste water was characterized by the presence of salt brine, dilute acid wastes, boiler blowdown, dilute latex, and coagulated rubber solids. Influent concentrations were BOD equal to 72 mg/liter, COD equal to 447 mg/liter, and suspended solids (SS) equal to 197 mg/liter. The treatment processes included neutralization, coagulation, flocculation, primary clarification, and sludge impoundment. Average reductions of 84.2% for BOD and 85.2% for SS were obtained. Conclusions reached as a result of the study included: a completely mixed aerated lagoon was ineffective in removing oxygen consuming pollutants; dissolved air flotation was the effective method for producing a high-quality effluent; chemical treatment could remove colloidal materials and produce an effective floc for initial and final dissolved air flotation clarification; final dissolved air flotation clarification was necessary to achieve a high-quality effluent and to prevent sludge autoxidation; the waste water was amenable to rapid biological oxidation; a retention time of approximately one day in the aerated lagoon produced the maximum BOD reductions; and the average sludge generation was 6.34 gallons/1000 gallons of waste water treated. The total project cost more than \$2,000,000, of which about 25 percent was used to separate process waste water from storm water. The average costs for operation, maintenance and depreciation were \$0.50 per 1000 gallons of treated waste water. (Orr-FIRL)

W76-07509

#### SECONDARY PLANT SHOEHORNED INTO SMALL SPACE,

Eastman Kodak Co., Rochester, N. Y. Utilities Div.; and Eastman Kodak Co., Rochester, N. Y. Waste Disposal Dept.

J. M. Lindsley.

Water and Wastes Engineering, Vol. 11, No. 10, p 18-21, October, 1974. 5 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Trickling filters, Aeration basins, Odor, Biochemical oxygen demand. Identifiers: \*Photographic industry wastes.

Eastman Kodak Company's utilities division at Kodak Park, Rochester, New York, is the company's primary photographic film, paper and chemical manufacturing complex. The waste water produced by the complex contains a wide variety of industrial wastes. The space available

for a secondary treatment plant was only about 10% of the land area normally required. The constraints required that innovative engineering and unusual features be incorporated in the treatment plant design. The unusual features include: the use of both trickling filters and aeration basins to perform secondary treatment; common walls between aeration and clarification basins; distribution ports in those walls rather than the customary center-column distributors; and, the rotating sludge collectors and high rate of flow over the weirs. Storm flow will be handled by a two million gallon standpipe for storage of excess flow rate over 54 mgd. Some primary treatment will be provided in the standpipe. Odors associated with the plant's operation are controlled by burning the odor-causing gasses at 1100 F. Currently, advanced treatment technologies and methods to reduce the BOD load in-plant, at the source, are being investigated. (Orr-FIRL)

W76-07510

#### METHOD FOR TREATING SOLUTIONS CONTAINING CYANOHYDRINS,

Establishments Kuhlmann, Paris (France).

Produits Chimiques.

P. Colin.

United States Patent 3,835,047. Issued September 10, 1974. Official Gazette of the United States Patent Office, Vol. 926, No. 2, p 609, September, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, \*Patents, Toxicity, Chemical reactions, Biodegradation.

Identifiers: \*Cyanohydrins, Hydrogen peroxide.

A patent has been issued for a method of treating aqueous solutions containing cyanohydrins. The resulting solution is made non-toxic by reacting the cyanohydrins with hydrogen peroxide to produce biodegradable oxamides. A similar method is also described for rendering solutions containing a metallic salt of hydrocyanic acid non-toxic. The cyanides contained in solution are reacted with carbonyl compounds and thereby converted to the corresponding cyanohydrin; the cyanohydrins are then reacted with hydrogen peroxide to form biodegradable oxamides. (Orr-FIRL)

W76-07511

#### ACID DRAINAGE CONTROL AND WATER TREATMENT AT HEATH STEELE,

Heath Steele Mines Ltd., Newcastle, (New Brunswick).

E. Busse.

Canadian Mining and Metallurgical Bulletin, Vol. 67, No. 751, November, 1974. 5 fig, 5 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Acid mine water, Heavy metals, Toxicity, Salmon, Environmental effects, Mine drainage, Costs, Chemical precipitation, \*Cana la.

Identifiers: Salmon migration, Miramichi River(Canada).

Heath Steele Mines Limited, New Brunswick, Canada, produces lead, zinc, and copper flotation concentrates from complex massive sulfide ores. Acid drainage from the mines was contaminating the Northwest Miramichi River and harming the salmon migration in the stream. The acid drainage was caused by underground and surface water contacting metal sulfides, becoming acidic and acquiring dissolved heavy metals. Previous attempts to treat the mine water and to collect the contaminated surface drainage water were insufficient. To meet governmental requirements, a comprehensive water pollution abatement program was started early in 1970 and became fully operational by the fall of 1972. Areas with contaminated surface drainage were identified and isolated. The water from these areas is collected, together with the water from underground workings and pumped to the tailings disposal area. It is then mixed with

the mill tailings and hydrated lime to precipitate the dissolved metals and to retain the metal hydrates and the tailings solids. Removal of 99.9% of the copper and zinc is achieved. The average metal toxicity in the Northwest Miramichi River has been reduced by 83 percent and peaks have been reduced by 92 percent. Control of drainage from the isolated contaminated areas is good; no escape of contaminated water from these areas to fresh water streams has been detected. The water quality of affected streams has improved substantially and the salmon migration has noticeably increased during the past two years. Capital cost of the project was \$2.5 million. The current annual operating costs are \$0.20 per ton of ore. (Orr-FIRL)

W76-07512

#### PRETREATMENT PROVIDES CONSTANT EFFLUENT QUALITY,

Syracuse Univ., Syracuse, N.Y. Dept. of Civil Engineering.

R. C. Faro, H. L. Kartiganer, A. Schneider, and D. Albano.

Water and Wastes Engineering, Vol. 11, No. 10, p 52-55, October, 1974. 2 fig, 6 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pre-treatment(Water), Textiles, Municipal wastes, Lagoons, Biochemical oxygen demand.

Identifiers: Combined municipal-industrial wastes, Flow equalization.

The pretreated effluent from the Majestic Weaving company, Cornwall, New York, is purified in combination with municipal wastes at the Town of New Windsor's municipal treatment plant. An agreement between the town and the mill requires the mill to pretreat its waste water and equalize the flow before discharge to the municipal system, limits the mill to a daily discharge of 1.25 million gallons, and requires that the mill pay a proportional share of the costs of waste water treatment plant expansion, interceptor sewer construction, and plant operation and maintenance. Pretreatment at the mill consists of two completely-mixed, deep, aerated lagoons. The lagoon system is sized to produce an effluent BOD of less than 350 mg/liter under the most critical winter flow design conditions of 1.25 mgd. The first year of operation has demonstrated the following advantages of this system: it is reliable and relatively trouble-free; it achieves a constant and predictable effluent quality; equalization and treatment can be performed in the same unit process due to the long lagoon detention time; the equalization storage duration of 24 hours allows the municipal plant operator the flexibility of choice in industrial effluent receipt, thus maximizing removal efficiency and minimizing risk of system upset; solids handling or sludge removal facilities are not required at the pretreatment plant since these are released to the municipal facility; capital construction costs were less than those for comparable pretreatment processes; and operation reliability was obtained with expenses limited to power, labor and maintenance supplies. (Orr-FIRL)

W76-07513

#### WASTES MAY NOT BE A TREAT FOR PRETREATMENT.

Chemical Week, Vol. 115, No. 15, p 27, 30, October 9, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pre-treatment(Water), Municipal wastes, Chemical wastes, Organic compounds, Biological treatment.

Identifiers: Combined municipal-industrial wastes, Chemical treatment.

Although combined treatment of municipal and industrial wastes is strongly advocated, the pretreatment necessary may make this an infeasible procedure for chemical wastes. The problems as-

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sociated with combining municipal and organic chemical industrial wastes are discussed. For example, introduction of a readily degradable organic waste water into an activated sludge plant may require readjustment of organic loading. In another case, while the COD in domestic sewage is primarily suspended and colloidal and therefore insensitive to temperature, soluble industrial waste waters require a biological removal mechanism that is affected by temperature, resulting in a need for adjustment for low winter temperatures. Levels of necessary pretreatment are higher for discharge of industrial wastes to a physical-chemical treatment plant than to a biological treatment plant. Types of possible pretreatment to facilitate joint municipal-industrial plants include evaporation, addition of lime, freezing, or membrane processes, as well as a recommendation that organic chemical manufacturing processes be modified to reduce the quantity of waste water and treatment inhibitors produced. While some organic chemical waste streams can never be treated together with municipal wastes because of their high toxicity levels, more joint treatment may be possible if organic chemical plants implement adequate pretreatment plants. (Orr-FIRL)  
W76-07514

**JOINT BIOLOGICAL PURIFICATION OF DOMESTIC AND INDUSTRIAL WASTE WATERS (SOVMESTNAYA BIOLOGICHESKAYA OCHISTKA KHOZYAYSTVENNOBYTOVOKH I PROIZVODSTVENNYKH STOCHNYKH VOD),**  
V. G. Mitevra, M. A. Luganskiy, I. K. Penke, M. A. Tomas, and I. S. Mal'kova.  
Vodosnabzheniya i Sanitarnaya Tekhnika, No. 10, p 18-20, 1974. 2 tab, 6 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Biological treatment, Domestic wastes, Aeration, Biochemical oxygen demand, Sedimentation.

Identifiers: Combined municipal-industrial wastes.

A process for the joint biological purification of domestic and industrial effluents is described. Following preliminary sedimentation, the mixed waste water is aerated for 18 hours in a first stage, and for another 30 hours in a second stage aerator. The specific air consumption is 50 cu m/cu m in the first stage, and 40 cu m/cu m in the second stage. The air consumption in the regenerator amounts to 70 cu m/cu m. The quantity of the circulation sludge amounts to 70% in the first stage, and to 100% in the second stage of the aerator. This biological treatment results in a purified effluent with a BOD level not exceeding 20 mg/liter. (Takacs-FIRL)  
W76-07515

**AN INVESTIGATION INTO THE PRETREATMENT AND EFFECT OF AN INDUSTRIAL WASTE WATER DERIVED FROM THE MANUFACTURE OF AZO DYES UPON THE ACTIVATED-SLUDGE PROCESS,**  
Prudhoe Water Pollution Control Works (England).

A. Tong, and R. A. Young.  
Water Pollution Control, Vol. 73, No. 5, p 584-588, November, 1974. 3 fig, 4 tab, 3 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Dyes, Chemical wastes, Activated sludge, Color, \*Pre-treatment(Water), Chlorination, Chemical oxygen demand.

Identifiers: Azo dyes.

The Prudhoe sewage works, Prudhoe, United Kingdom, receives industrial effluent from a plant which manufactures azo dyes. This effluent has in the past given a red coloration to the sewage works' effluent and also to the river in which the effluent was discharged. Pretreatment of the industrial waste water by chlorination was instituted

to reduce the intensity of the color of both the raw waste water and the effluent from the sewage works. An investigation has recently been conducted on the effect that the chlorinated azo dye waste water has upon the activated sludge process utilized at the Prudhoe works. It was concluded that neither azo dyes nor chlorinated azo dyes have an appreciable effect on activated sludge. Chemical oxygen demand and optical density studies indicate that the effluent passes through an activated sludge plant relatively unchanged. Chlorination appears to be the only practical method for color and COD removal from azo dye wastes. However, more dangers may be present in chlorination than in leaving the color. At least 17 chlorinated organic groups were found in samples of the chlorinated waste water collected over one week. (Orr-FIRL)  
W76-07516

#### A SOLUTION TO A PROBLEM OF FILTER CLOTH BLINDING,

Water Pollution Research Lab., Stevenage (England).

M. J. D. White, and R. C. Baskerville.  
Effluent and Water Treatment Journal, Vol. 14, No. 9, p 503-505, September, 1974. 1 fig, 3 tab, 5 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, Filtration, Grease, Sludge treatment, Lime.

Identifiers: Filter cloth blinding, Sludge conditioning, Ferric chloride.

The sewage works at St. Ives, Huntingdonshire, United Kingdom, was designed to treat 1500 cu m of sewage per day but now treats 2680 cu m per day of which about 20% is industrial. The BOD of the industrial waste is close to 2000 mg/liter and it seems to contain unusually high quantities of grease. A problem of filter blinding when dewatering the sludge (possibly caused by the high grease content) was so severe that filtering of the sludge was abandoned and the sludge was disposed of by tanker or dried on beds. A laboratory method for assessing filter cloth blinding together with an assessment of filtrability was used by the Water Research Centres' Stevenage Laboratory, Herts, to choose a conditioning system that was suitable for a sludge with such a high grease content. Results of the study indicated that ferric chloride and lime should be used instead of the previously recommended aluminum chlorhydrate. The use of ferric chloride and lime has enabled the treatment works to obtain a net yield of sludge cake of 12 kg/sq m hr at a cake solids content of 19%, which is greater than the design yield of the filter. The frequency of cloth washing has been reduced to once per 300 hours but is still more frequent than average values. (Orr-FIRL)  
W76-07517

**IMPROVED FORMAZAN TEST FOR THE DETERMINATION OF THE DEHYDROGENASE ACTIVITY OF ACTIVATED SLUDGE IN WASTE WATER TREATMENT PLANTS FOR THE JOINT BIOLOGICAL PURIFICATION OF URBAN AND TANNERY-GENERATED WASTE WATERS (VERFEINERTER FORMAZANTEST DER DEHYDROGENASEAKTIVITAET VON BELEBTSCHLAEMMEN IN ANLAGEN ZUR GEMEINSAMEN BIOLOGISCHEM REINIGUNG VON GERBEREIAWAESSERN UND STAEDTISCHEN AWAESSERN),**  
J. Gajdusek, J. Kupec, and J. Svacner.  
Wasserwirtschaft-WasserTechnik, Vol. 24, No. 6, p 193-194, 1974. 5 fig, 4 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Tannery wastes, Activated sludge, Municipal wastes, Analytical techniques, \*Pollutant identification.

Identifiers: Dehydrogenase activity, Formazan test, Combined municipal-industrial wastes.

An improved formazan test has been developed for the determination of the dehydrogenase activity of activated sludge in waste water treatment plants. The plants purify combined urban and tannery-generated waste waters. The influence of temperature and pH value on the result of the formazan (TTC) test was studied. The TTC method is based on the enzymatic reduction of the colorless 2,3,5-triphenyl-tetrazolium chloride by reductases to red 2,3,5-triphenylformazan which is subsequently determined quantitatively by a colorimetric method. The rate of reduction of the reductase activity is proportional to that of the biological activity, or to the performance of the activated sludge. Incubation tests conducted at 20°C in a pH range of 6-11 revealed highest 2,3,5-triphenylformazan output at pH values between 9 and 10. Tests performed at pH 7 in a temperature range of 5-30°C revealed a nearly linear increase of 2,3,5-triphenylformazan output with temperature. (Takacs-FIRL)  
W76-07518

**STATUS AND PERSPECTIVES OF THE IMPROVEMENT OF BIOCHEMICAL WASTE WATER TREATMENT FACILITIES IN PETROLEUM REFINING PLANTS (SOSTOYANIYE I PERSPEKTYV SOVSEHENSTVOVANIYA SOORUZHENIY BIOKHIMICHESKOY OCHISTKI STOCHNYKH VOD NPZ),**  
V. Ya. Gerber.  
Khimya i Tekhnologiya Topliv i Masel, No. 9, p 10-14, 1974. 6 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, Oil industry, \*Biological treatment, Aeration, Activated sludge, Reviews, \*Treatment facilities, \*Oil wastes.

Identifiers: Refinery wastes.

The state-of-the-art and perspectives in the development of biological waste water treatment in petroleum refining plants are presented. Ordinary effluents are treated in one-stage aeration tanks for 6 hrs at an air expenditure of 20-25 cu m per cu m of water and an activated sludge concentration of 2-3 g/liter. The phosphorus and nitrogen levels are adjusted to 3 and 15 mg/liter, respectively. The waste water thus treated is settled in a settler for 3 hrs. The emulsion-containing, saline waste water is first treated with de-emulsifiers. Non-ionogenic, biodegradable emulsifiers have been developed for this purpose. Possibly combined with municipal or chemical waste water, the de-emulsified waste water is then purified in aeration basins; this process can be substantially improved by the use of technical oxygen in place of oxygen in tight tanks, and of sectional, displacement type aeration tanks instead of stirrer type tanks. Final purification can be performed in lagoons. (Takacs-FIRL)  
W76-07519

**CONTROLLING PHENOLS IN REFINERY WASTE WATERS,**  
Robert S. Kerr Environmental Research Lab., Ada, Okla.  
R. W. Short, Jr., B. L. DePrater, and L. H. Myers.  
The Oil and Gas Journal, Vol. 72, No. 47, p 119-124, November 25, 1974. 7 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, Oil industry, \*Phenols, Biological treatment, Activated carbon, Analytical techniques, \*Oil wastes.

Identifiers: Refinery wastes.

The control of phenols in petroleum refinery waste waters has been of concern for some time. A review is given of cooperative field studies by petroleum refiners, various regulatory agencies, and the American Petroleum Institute. The various studies identified the sources of phenolics in petroleum refining as the catalytic cracking process, the caustic treatment of cracked gasoline, and hydrocracking. Analytical reliability of

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refinery waste water data, using EPA methodology, was improved by a seminar on analytical procedures. Both biological and activated carbon treatment systems demonstrated a high capacity for removal of phenolics. However, biological systems were found to be easily upset by changes in phenolics concentration. Activated carbon systems can provide excellent treatment if the pH of the waste streams is controlled; caustic conditions in the activated carbon columns must be prevented. (Orr-FIRL)  
W76-07520

**BASIC TRENDS IN THE IMPROVEMENT OF WATER SUPPLY, SEWER AND WASTE WATER TREATMENT SYSTEMS AT PETROLEUM PROCESSING PLANTS (OSNOVNYYE NAPRAVLENIYA V SOVERSHENSTVOVANII SISTEM VODOSNABZHENIYA, KANALIZATSII I OCHISTKI STOKOV NPZ),**  
A. S. Eygenson, and E. G. Ioakimis.  
Khimiya i Tekhnologiya Topliv i Masel, No. 9, p 7-10, 1974. 8 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, Oil industry, Recycling, Water reuse, Biological treatment, \*Oil wastes, Sewers, Water supply.

Identifiers: Refinery wastes.

Basic trends in waste water treatment in the petroleum processing industry of the USSR are outlined. Efficient biological treatment plants, including oil traps, secondary settling tanks, sand filters, floatators, and one- or two-stage aerators are available at most of the petroleum processing plants. Recycling of the industrial water following biological purification is envisaged. The sulfurous, lye-containing effluents with high phenol and ammonia contents are the most polluted waste waters of petroleum processing plants. Such effluents should be treated by means of regenerable reagents in place of caustic soda, and technologies eliminating or minimizing such effluents should be developed. Methods for the recovery of sulfur and ammonia from such waste waters are being studied. The biological purification, usually conducted at a water flow rate of 0.3-0.5 m/sec, can be intensified by the use of technical-grade oxygen instead of air. (Takacs-FIRL)  
W76-07521

**ULTRAFILTRATION OFFERS 'GOOD' REMOVAL OF COLOR, COD, BOD,**  
Lakehead Univ., Thunder Bay (Ontario). Dept. of Chemical Engineering.  
M. Fels, D. Smith, C. Miller, and P. Miller.  
Canadian Pulp and Paper Industry, Vol. 27, No. 9, p 50-52, September, 1974. 4 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Pulp and paper industry, Color, \*Chemical oxygen demand, \*Biochemical oxygen demand, Membrane processes, Costs.  
Identifiers: \*Ultrafiltration.

An investigation was conducted of the effects of ultrafiltration on bleached Kraft mill effluent with respect to COD, BOD<sub>5</sub>, and color reductions. The unit used in this study was a Amicon Ultrafiltration Cell, Model 4015. The liquid is forced through a Diaflo Ultra Membrane under pressure; solvents and low molecular weight components pass through the membrane and are the ultrafiltrate, the molecules of higher molecular weight are rejected by the membrane and remain in the cell as the concentrate. Ultrafiltration is considered to provide good removal of color, COD and BOD loadings. The cost of this process is relatively high. A 500 ton/day plant with an operating cost of \$1.00/1000 gallons would require a capital investment of \$20-\$50 million. The results of the study indicate that maximum effectiveness is gained by using a membrane which has a molecular weight cutoff of 10,000. Since color, COD and BOD removal are

not dependent on pressure, the process has the advantage of operating at low pressures as opposed to reverse osmosis which must operate at a very high pressure. The stirring rate was found to be an important parameter for practical applications. Design work on the hydrodynamic aspects of the equipment must be considered together with the membrane characteristics. (Orr-FIRL)  
W76-07522

**CHEMICAL RECOVERY PROCESS FOR SPENT COOKING LIQUORS,**  
Hiroshima Inst. of Tech., Itsukaichi (Japan).  
M. Ono, and M. Yoneda.

Mitsubishi Heavy Industries Technical Review, Vol. 11, No. 1, p 61-67, February, 1974. 9 fig, 1 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, Pulp and paper industry, \*Sulfite liquors, \*Pulp wastes, Aeration, Separation techniques, Recycling.

Identifiers: Kraft pulping wastes, \*Chemical recovery.

A new chemical recovery process for sulfite spent cooking liquor in the paper and pulp industry is summarized. Sodium carbonate is first separated by evaporating the smelt solution obtained by burning concentrated spent liquor in a recovery boiler. The sodium sulfite is produced in crystalline state by oxidizing the mother liquor of sodium sulfide with air in a sodium hydroxide solution which ranges from 15 to 25% by weight at a temperature over 100°C. Thus, in the first step the process crystallizes and separates Na<sub>2</sub>CO<sub>3</sub> from the water solution of smelt and in the next step aerates Na<sub>2</sub>S filtrate in NaOH solution to turn the Na<sub>2</sub>S into Na<sub>2</sub>SO<sub>3</sub> crystal. Compared with conventional processes, this is simpler and is also capable of regenerating Na<sub>2</sub>SO<sub>3</sub> of comparatively high purity. This method is applicable to a wide production ratio of pulps for the cross recovery of kraft spent liquor and sulfite spent liquor. (Murphy-FIRL)  
W76-07525

**STUDIES ON THE REMOVAL OF HEAVY METAL IONS FROM WASTE WATER BY FLOTATION METHOD WITH ANIONIC SURFACTANT I. - REMOVAL OF TRACES OF CADMIUM ION WITH SODIUM DODECYLBENZENE SULPHONATE, (IN JAPANESE),**  
M. Nakagawa, and Y. Kaida.  
Reports of Government Industrial Research Institute (Kyushu), No. 9, p 10-18, 1973. 12 fig, 18 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Heavy metals, Surfactants, \*Cadmium, \*Flotation, \*Ions, Trace elements.

Identifiers: Sodium dodecylbenzene sulfonate.

The removal of heavy metal ions from waste water by a flotation method using an anionic surfactant was investigated. Specifically, traces of cadmium ions were removed with sodium dodecylbenzene sulfonate (DBS). The residual concentration of Cd in the flotation (15 to 30 minutes) of Cd nitrate solution (one ppm Cd) was 0.03 to 0.05 ppm at a pH of 4 to 11. The probable chemical species of Cd removed are divalent cations at pH 4 to 9 and precipitates of hydroxide at pH 5 to 11. With the addition of P04(3-), remarkable effects upon the removal were shown in the formation of a certain Ca-Cd-hydroxyphosphate. After the effective height of the foam layer in the cell for the flotation was defined, the effect of repeating the flotation two times was examined. The residual concentration after repetition was 0.1 ppm or less in the case of one ppm initial Cd, and 50 ppm Ca, with the addition of P04(3-), being kept equivalent to the initial Cd, and 10 ppm DBS for each flotation. (Murphy-FIRL)  
W76-07524

**EXTRACTION OF VANADIUM AND CHROMIUM FROM EFFLUENTS.**

Netherlands Patent NL 7313-348. Issued April 9, 1974. Derwent Netherlands Patents Report, Vol. V, No. 17, p M1, May 31, 1974.

Descriptors: \*Patents, \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, Metals, \*Chromium, \*Separation techniques.

Identifiers: \*Vanadium.

A method was patented for the extraction of vanadium and chromium from effluents using aliphatic amines as the extraction agent. This is a two phase process whereby aqueous solutions containing dichromate and polyvanadate ions are treated. In the first phase, dichromate ions are selectively extracted at pH 1-3 with aliphatic amines. The chromium is recovered by extracting the organic phase with alkali hydroxide solution. In the second stage, the remaining polyvanadate ions are extracted from the aqueous solution at pH 3.5-5 using a similar extracting agent. The organic phase is again extracted with an alkali hydroxide solution. One suitable extracting agent is tri-n-octyl/tri-n-decyldiamine, mixed with a high boiling aromatic hydrocarbon. (Murphy-FIRL)  
W76-07525

**METHOD FOR INSOLUBILIZING WATER SOLUBLE CHROMATE IN CHROME WASTE RESIDUE,**  
Nippon Denko Co. Ltd., Tokyo (Japan).  
(Assignee).  
S. Adachi.

United States Patent 3,803,032. Issued April 9, 1974. Official Gazette of the United States Patent Office, Vol. 92, No. 2, p 702-703, April, 1974. 1 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Metals, \*Patents, Lignite, Pulp wastes, Activated carbon.

Identifiers: Chromate insolubilizing, \*Chrome wastes.

A patent was granted for a method of insolubilizing water soluble chromate in chrome waste residue. This water-leached residue occurs from roasted products which are obtained by the alkali oxidizing roasting of chrome ore. The chromate may be insolubilized and fixed into the residue by mixing the lumpy and/or powdery water-leached residue with organic materials. These organics are capable of being converted into activated carbon, by roasting the mixture in a gaseous atmosphere with low oxygen concentration. A gas temperature of 400 to 1000 C and a material temperature of 400 to 700 C is used to quench the roasted product. The organic materials used include pulp waste liquor, lignite, sawdusts, pulp sludge, and chaffs. (Murphy-FIRL)  
W76-07526

**POLYMERS SOLVE WASTE WATER PROBLEMS,**

Betz Labs. Inc., Trevose, Pa.  
W. R. Cook, and L. V. Rankin.  
Iron and Steel Engineer, Vol. 51, No. 5, p 43-46, May, 1974. 5 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Steel, Metals, \*Polymers, \*Polyelectrolytes, Flocculation, Coagulation.  
Identifiers: Iron and steel industry.

The iron and steel industry uses millions of gallons of water and accumulates many tons of contaminants including metallic particles, dirt, oil, grease, carbon, and acid. The use of polymers (polyelectrolytes) has been applied to alleviate waste water problems. However, the uses and effects of such polyelectrolytes in flocculation and coagulation are still uncertain. Variables such as type of charge, density of charge, and molecular weight influence a particular polymer's effective-

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ness. On-site testing proved to be the best method for choosing a polymer for a particular system. In the iron and steel industry, polymers are used for influent clarification, gas scrubber systems, hot mill systems, cold mill operations, and sludge handling. (Murphy-FIRL)  
W76-07527

**INCINERATION GIVES NEAT ANSWER TO PHARMACEUTICAL WASTES DISPOSAL PROBLEMS.**  
For primary bibliographic entry see Field 5E.  
W76-07529

**ABSORPTION CLEANING OF ORGANIC EFFLUENT VAPOURS,**  
Y. G. Sukharev, Z. A. Simanenko, and V. A. Stepanov.  
Soviet Patent SU 391842. Issued December 13, 1973. Soviet Inventions Illustrated, Vol. V, No. 18, p J5, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Absorption, Chemical wastes, Air pollution, Organic compounds, \*Patents, Odor.  
Identifiers: Effluent vapors, Polyorganosiloxane liquids.

A patent was issued for the use of a lower polyorganosiloxane liquid as an absorbent in the cleaning of organic effluent vapors. Such solvent vapors as aromatic and aliphatic hydrocarbons were shown to be most effectively absorbed and regenerated by the use of polyethylsiloxane liquids, such as No. 3 (GOST 13004-67), as the absorbent. Absorption equipment may be conventional; the vapors are absorbed at 20 to 40 C. As an example, an air-vapor mixture containing 5 mg/liter turpentine was purified using polyethylsiloxane liquid No. 3, with an adsorption volume for turpentine of 19%. (Murphy-FIRL)  
W76-07530

**EFFLUENT TREATMENT IN THE LEAD CRYSTAL INDUSTRY,**  
J. B. Cappi.  
Glass, Vol. 51, No. 4, p 143-145, April, 1974. 1 fig, 2 tab, 2 photo.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, \*Lead, Suspended solids, Neutralization, Chemical precipitation, Coagulation, Fluorides, Sulfates.  
Identifiers: Lead crystal manufacturing wastes, Lead oxide.

A control system for effluents produced from lead crystal manufacture was established by the Serck Eftrol company. These toxic discharges contain up to 35% lead oxide which originates from cutting, polishing and fume scrubbing. Contaminants which must be processed are suspended solids, fluorides, sulphates, and lead. The basis of the described treatment scheme was neutralization of the combined discharge which also serves to precipitate fluorides, sulphates, and lead, and to coagulate the colloidal suspended solids. One glass manufacturing plant in the Stourbridge area of Worcestershire was analyzed, with results of discharge limits for the effluent in terms of fluorides and sulphates. Operating data on the plant included flow rates, reagent consumptions, sludge production, and manpower requirements. (Murphy-FIRL)  
W76-07531

**ON THE APPLICABILITY OF THE BOD PARAMETER TO THE CHARACTERIZATION OF COKING PLANT-GENERATED EFFLUENTS (VOPROS O PRIYEMLEMOSTI POKAZATEL'VA BPK DLYA KHARAKTERISTIKI STOCHNYKH VOD KOKSOKHIMICHESKIH ZAVODOV),**  
I. I. Khlopkova, G. I. Papkov, Ye. D. Schastlivchenko, and V. A. Mgen.

Koks i Khimiya, No. 3, p 29-31, 1974. 3 tab, 12 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Chemical wastes, \*Biochemical oxygen demand, Biodegradation, Phenols, Temperature, Aeration.

Identifiers: Coking plant effluents, Rhodanides.

A study has been carried out to determine the relevancy of the BOD parameter for the characterization of coking plant-generated effluents. The BOD determination had poor reproducibility due to the high concentration of ammonia and ammonia salts in the phenol-containing waste waters. The BOD parameter was found unsuitable for the characterization of the degree of pollution of phenol-containing coking plant effluents and for the design of biochemical treatment plants due to the presence in them of various components, such as phenol and rhodanides with greatly differing rates of biochemical degradation. The rates of biodegradation of phenol and rhodanide, measured at 32 C, were found to be 100 mg/liter and 30-35 mg/liter, respectively. Both rates increased with increasing temperature. The volume and the operation of the aeration tanks for the biochemical treatment of coking plant-generated effluents should be determined with respect to the rhodanides as the least oxidizable pollutants. (Takacs-FIRL)  
W76-07532

**TREATMENT AND DISPOSAL OF WASTE-WATER FROM ONION DEHYDRATION FACTORY AT SATPUR, NASIK,**  
Maharashtra Engineering Research Institute, Nasik (India).  
G. B. Ambawane, N. Y. Dhekane, P. V. Patki, and B. R. Kapre.  
Journal of the Institution of Engineers (India), Vol. 54, Part PH1, p 10-13, October, 1973. 1 fig, 3 tab, 4 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Food processing industry, Odor, Sedimentation, Coagulation, Aeration, Oxidation lagoons, Dehydration, Waste water disposal.  
Identifiers: Extended aeration, \*Onion dehydration wastes, Oxidation ditches.

An onion dehydration plant in India with a capacity of 30 to 33 tons per day produced about 272,400 liters of waste water per day, which, besides having substantially high loads of pollution, was also characterized by a pungent odor. Possible treatment methods tried included sedimentation, spray disposal, use of coagulants such as aluminum sulphate, ferric chloride, and ferrous sulphate (alone and in conjunction with lime), and extended aeration in an oxidation ditch. Of the methods tested, extended aeration in an oxidation ditch appeared to be the most practical. Advantages of this method included: simplicity and low initial investment in equipment; low production of sludge; low maintenance costs; BOD reduction of 95%; pungent odor removal; and excellent settling characteristics. (Murphy-FIRL)  
W76-07533

**ANALYSIS OF SOME PHYSICAL PROPERTIES OF POULTRY PROCESSING CHILLER EFFLUENT,**  
Richard B. Russell Agricultural Research Center, Athens, Ga.  
W. K. Whitehead.  
Poultry Science, Vol. 53, No. 2, p 571-574, March, 1974. 1 fig, 1 tab, 2 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Food processing industry, Costs, Water reuse, Biochemical oxygen demand, Dissolved solids, Suspended solids, Screening, Treatment facilities, Poultry, \*Recycling.  
Identifiers: \*Poultry processing wastes.

Poultry processing plant chiller effluent is normally discharged to the sewer with no reuse of the water. By recycling the chiller water, a processing plant with capacity of 9600 birds per hour could save 10,000 dollars per year in water and refrigeration costs. Five such plants were sampled and physical properties of the waste water were measured to determine BOD, fat, and total and suspended solids content. Over 60% of the total solids in the waste water were dissolved solids, which could not be removed by screening and filtering. However, 51% of the suspended solids and 77% of the settleable solids could be removed by a 325 mesh sieve. (Murphy-FIRL)  
W76-07534

### TREATMENT OF DAIRY EFFLUENT WATERS TREATMENT.

French Patent FR 2187-704. Issued February 22, 1974. Derwent French Patents Abstracts, Vol. V, No. 11, p D6, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Food processing industry, \*Patents, Dairy industry, Fermentation, Aerobic conditions, Bacteria, Suspended solids, Separation techniques.  
Identifiers: \*Dairy effluents.

A method of dairy waste water effluent purification is described. The effluent waters are purified by fermenting the material at 20-37 C with an aerobic and non-pathogenic bacteria strain containing 1 beta-galactosidase or a lactose oxidase, followed by separation of the bacterial material. Whey from cheese manufacture is generally fermented with a bacterial strain of the Enterobacter or *Serratia* species at 25-30 C and pH 6.7 for about 48 hours after which the medium is centrifuged to separate the bacterial solids. Ten percent of the culture is retained for the next batch and the remainder of the protein-rich bacterial mass can be used as animal feed. The treated effluent has a much lower content of solids and of reducing sugars such as lactose. (Murphy-FIRL)  
W76-07535

### CANDY WASTE TREATMENT, W. D. Hatfield.

Industrial Wastes, Vol. 22, No. 2, p 20-22, 32, March/April, 1974. 2 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Food processing industry, Activated sludge, Lime, Costs, Capital costs, Biochemical oxygen demand, Hydrogen ion concentration, Nitrogen, Phosphorus, Nutrient requirements, Illinois.  
Identifiers: \*Candy manufacturing wastes, Carbohydrate wastes.

The Lucy Ellen Candies' plant in Sullivan, Illinois, was producing 12,000 gallons/day of industrial and domestic sewage with a BOD of 420 lbs. In order to achieve a 90% BOD reduction, or about 50 lbs/day, three alternative treatment methods were considered. These were: complete mix activated sludge with mechanical aeration, activated sludge diffused air in a pre-fabricated package unit, and trickling filter (surf plastic media) with recirculation. Of these, the first plan was selected. After initial start-up time and sludge build-up, effluent BOD was reduced to 50-150 mg/liter which was more than sufficient to meet the required standard of 500 mg/liter. It was necessary to add lime softener sludge from a local water works plant to weight down the activated sludge and to control pH at the desired value of 7.7.2. Ammonia nitrogen and phosphorus nutrients were also required because the carbohydrate waste from the candy operation lacked these essential chemicals. Costs of the system were given as \$35,600 capital investment plus power costs for operation of \$3.70/day. No operating or maintenance costs were provided. (Murphy-FIRL)  
W76-07536

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**LIQUID WASTE TREATMENT FOR THE PETROLEUM REFINING INDUSTRY (SEIKIYU SEISEI NI OKERU H AISUI SHORI),**  
K. Fujimori, and F. Sato.  
Nenryo oyobi Nenso, (Fuel and Combustion) Vol. 41, No. 7, p 635-640, July, 1974. 3 fig.

**Descriptors:** \*Industrial wastes, \*Waste water treatment, \*Activated sludge, \*Oil wastes, Separation techniques, Incineration, Sludge treatment, Sedimentation, Liquid wastes.

**Identifiers:** \*Petroleum wastes.

The Mizushima Refinery of the Japan Mining Company installed an API oil separator and a coagulation settling tank (clarifier) at the time of its initial operation in 1961. More recently, an activated sludge treatment system together with a dehydration system and sludge incineration system was constructed, based on the new water quality standards and water protection laws. Waste water in a refinery is one of three types: rainwater, sea water for cooling, or oil containing liquid waste. The third is comprised of liquid wastes from the refining system, scrubber, pump seal water, tank drains, and rainwater containing oil, and requires special treatment. These liquid wastes contain emulsified oil, preservatives, chemicals of various kinds, sulfides, and impure substances in crude oil. The mixture of these is first treated in the API oil separator. After adjusting pH, the liquid is fed into the activated sludge treatment system. Part of the liquid is fed into the clarifier. Part of the treatment water is used in the aeration tank, settling tank spray water, and the incineration system dust collector. The emulsion from the API oil separator is sent to a centrifugal separator; oil is recovered and sludge is sent to the incinerator. (Seigle-FIRL)  
W76-07537

**EXPERIENCE WITH THE PURIFICATION OF WASTE WATER IN RESERVOIRS (OPYT OCHISTKI STOCHNYKH VOD V REZERVUARKH),**  
V. M. Zikunov, and A. Sh. Akzigitov.  
Neftepromyslovoe Delo, Vol. 1, p 38-40, March, 1974. 2 fig, 1 tab.

**Descriptors:** \*Waste water treatment, \*Industrial wastes, \*Oil wastes, Sedimentation, Equipment, Oxygen, \*Dewatering, Separation techniques, \*Settling basins.

**Identifiers:** \*Petroleum wastes, Stratal water, Crude oil.

Experiences with the purification of stratal water and other effluents containing petroleum products, as generated during the dewatering and processing of crude oil, are presented. The stratal water separated from crude oil is admitted to vertical settling tanks without contacting oxygen. The stratal water is admitted to the petroleum layer floating on the surface by means of jet baffles. The floating petroleum layer is drained for recirculation in the dewatering process, and the purified water, after emulsion separation, is drained at the bottom and discharged in wells. Waste waters and relatively pure effluents containing oxygen decrease the efficiency of the settling tanks; they should be treated separately. (Takacs-FIRL)  
W76-07538

**SOLUTION TO THE WASTEWATER PROBLEM IN THE SHEET-METAL PROCESSING INDUSTRY (LOESUNG VON ABWASSERPROBLEMEN DER BLECHVERARBEITER),**  
K. Marquardt.  
Baender Bleche Rohre, Vol. 15, No. 4, p 161-164, 1974.

**Descriptors:** \*Ion exchange, \*Reverse osmosis, \*Metals, \*Waste water treatment, \*Industrial wastes, Water reuse, Recycling, Effluents.

**Identifiers:** \*Ultrafiltration, Electroplating, Sheet metal processing.

The function and uses of ion exchangers, reverse osmosis, and ultrafiltration in the purification of waste waters generated in the sheet-metal processing industry in general, and in electroplating shops in particular, are described. Ion exchangers with regeneration in counterflow permit considerable reduction in reagent and water expenditure. Strong basic anion exchangers should have a pre-stage in the form of a weak basic anion exchanger for the removal of organic compounds and heavy metal-cyanide complexes from the strong basic ion exchange resin in counterflow. It is possible to automate ion exchangers for continuous or semi-continuous operation and reduced reagent consumption. Reverse osmosis, possibly combined with ultrafiltration and the ion exchange process, is suitable for: the recovery of precious metals and reagents; the preparation of drinking water and high-purity water; and the detoxification of toxic effluents such as those generated in the electroplating industry. (Takacs-FIRL)  
W76-07539

**CHROMIUM REMOVAL FROM WASTE-WATER BY ELECTROCOAGULATION (ELEKTROKOAGULATSIONNAYA OCHISTKA STOCHNYKH VOD OT KHROMA),**  
G. A. Selitskii, and N. P. Antropov.  
Tsvetnyye Metally, No. 4, p 85-86, 1974. 1 fig, 1 tab.

**Descriptors:** \*Chromium, \*Waste water treatment, \*Electrolysis, Industrial wastes, Anodes, Cathodes, Coagulation.

**Identifiers:** Electroplating, \*Electrocoagulation, Steel electrodes.

A simple, highly effective method removes hexavalent chromium from industrial waste waters as generated in electroplating processes by electrocoagulation. The waste water containing chromates is subjected to electrolysis between steel electrodes, whereby bivalent iron and hydrogen are released by the anode and cathode, respectively. The bivalent and trivalent iron ions and the trivalent chromium ions reduced from hexavalent chromium form hydroxides that can be quantitatively separated. Electrolysis is conducted with direct current, using a current density of 0.8-1.2 A/sq dm for chromate concentrations up to 120 mg/liter. Electrolysis takes 15 to 20 minutes. It was found possible to quantitatively remove chromium from waste waters by this electrocoagulation process. (Takacs-FIRL)  
W76-07542

**THE OPERATION OF THE FLOTATING HYDROCYCLONE IN THE CLARIFICATION OF ROLLING MILL-GENERATED WASTE-WATERS (RABOTA GIDROTSIKLONA-FLOTATORA DLYA OSVETLENIYA STOCHNYKH VOD PROKATNYKH TSEKHOV),**  
L. D. Subbotkin.  
Tsvetnyye Metally, No. 4, p 86-87, 1974. 1 fig.

**Descriptors:** \*Waste water treatment, \*Copper, \*Zinc, \*Suspended solids, \*Oil wastes, \*Industrial wastes, Metals.

**Identifiers:** Rolling mill wastes.

The use of floating hydrocyclones for the clarification of rolling mill-generated waste waters containing 0.4-0.5 mg copper, 0.6-0.7 mg zinc 10-50 mg suspended matter, and 50-200 mg petroleum products per liter is discussed. The pressure under which the waste water is to be saturated with air (calculated as a function of the water and air expenditures, air density, the solubility of nitrogen in water, the duration of the saturation, and the rate constant of the solution of air in water) was found to be 3.5 atm. Experiments with floating hydrocyclones of one to two m in diameter under practical conditions revealed efficiencies of 50-60% for suspended matter, and 60-70% for petroleum products. The residual suspended matter and petroleum product contents in the clarified water

were in the respective ranges of 10-25 mg/liter and 30-50 mg/liter. (Takacs-FIRL)  
W76-07541

**WASTE WATER TREATMENT BY MEANS OF ION EXCHANGE RESINS (TRATTAMENTO DI ACQUE DI SCARICO CON RESINE A SCAMBIO INOIICO),**  
La Nouva Chimica, No. 3, p 71-75, March, 1974.

**Descriptors:** \*Ion exchange, \*Waste water treatment, \*Recycling, Water reuse, Industrial wastes, Metals, Copper, Nickel, Zinc, Cadmium, Sodium, Cyanides, Activated Carbon, Resins.

**Identifiers:** \*Electroplating, Ion exchange resins, Cationic ion exchange resins.

The technological and economic advantages of the use of ion exchange resins for waste water treatment, especially in the electroplating and surface-treatment industries, are described. The water treated by ion exchange resins is of constant quality regardless of fluctuations in ion concentration. Ion exchange resins are also suitable for the recycling of process water after the removal of ions, and for the recovery of precious metals from liquids. Lewatit ion exchange resins are used for the removal of chromates, cyanides, and other toxic substances including nonionicogenic substances, from process waters. The waste water to be treated by ion exchange resins should be purified by filters or activated carbon. Cationic ion exchange resins are regenerated by means of hydrochloric or sulfuric acid, and caustic soda is used for the regeneration of anionic resins. It is possible to economically remove copper, nickel, zinc, cadmium, sodium, chromic acid, cyanides, phosphoric acid, and nitric acid from process waters provided their individual concentrations are below 500 mg/liter. (Takacs-FIRL)  
W76-07542

**APPLICATION OF SIMILITUDE AND MODELING IN WASTE WATER TECHNOLOGY (ANWENDUNG DER AHNLICHKEIT UND MODELLIERUNG IN DER ABWASSERTECHNOLOGIE),**  
I. Horvath.

Gas und Wasserfach, Wasser/Abwasser, Vol. 115, No. 3, p 128-136, March, 1974. 8 fig, 30 ref.

**Descriptors:** \*Waste water treatment, \*Treatment facilities, \*Model studies, Kinetics, Equipment, Chemical industry, Operation, Design.

Problems and possibilities of the application of the similarity theory in modeling waste water treatment facilities with respect to scale-up are discussed. In the study of waste water treatment, technology and equipment, geometric, kinetic, and dynamic resemblances, as well as similarities in material transfer, reaction kinetic, and biological processes are of primary interest. While it is impossible to achieve absolute similarity, satisfactory results can be obtained by approximate modeling. Results achieved in the areas of zymology, chemical industry, and hydrology will be valuable in the study of modeling and scale-up with respect to waste water treatment plants. (Takacs-FIRL)  
W76-07543

**EXTRACTIVE-POLAROGRAPHIC DETERMINATION OF STYRENE AND METHYL-METACRYLATE IN INDUSTRIAL WASTES (EKSTRAKTSIONNO-POLYAROGRAFICHESKOYE OPRYEDENIYE STIROLA I METILMETAKRILATA V PROMYSHLENNYKH STOCHNYKH VODAKH),**  
For primary bibliographic entry see Field 5A.  
W76-07544

**POSSIBILITIES OF AUTOMATING THE OPERATION OF CLARIFYING THICKENERS IN PROCESSING PLANTS BY USING OR-**

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

**GANIC-SYNTHETIC FLOCCULANTS (MOYENS D'AUTOMATISER PAR L'EMPLOI DE FLOCULANTS ORGANIQUES SYNTHETIQUES LE FONCTIONNEMENT DES EPASSISSEURS CLARIFICATEURS UTILISES DANS LES INSTALLATIONS DE PREPARATION),**

J. Reuter.

Aufbereitungs-technik, Vol. 15, No. 4, p 187-193, 1974. 8 fig, 7 ref.

Descriptors: \*Sludge treatment, \*Waste water treatment, Flocculation, Pulp and paper industry, \*Pulp wastes, \*Industrial wastes, Polymers, Flow rate, \*Automation.

Identifiers: \*Sludge thickening, Polyacrylamide.

The operation of a clarifying thickener, used in technological processes for continuous solid-liquid separation of pulps, can be automated by using synthetic flocculants, such as polyacrylamide, as long as the requirement is maintained for keeping the overflow water always free of settleable matter. The organic flocculant is added immediately before admission of the pulp to the thickener at a rate not higher than 0.1 percent. The volume and the solids content of the pulp feed are measured (the volume by a magnetic-inductive method and the solids content by radiometry) continuously, and the product of the two measured values will give the quantity of the solid matter being fed to the thickener. The flocculant metering is regulated automatically as a function of the solids volume. For maintaining a uniform degree of sludge thickening, the level in the thickener is monitored permanently by means of dip pipes or a depth-finder, or radiometrically by isotope barriers. The sludge quantity to be withdrawn is regulated as a function of the flow rate of the sludge pump in such a way that the level in the thickener remains almost identical. (Takacs-FIRL)

W76-07545

**PLASMA TREATMENT OF TEXTILES: A NOVEL APPROACH TO THE ENVIRONMENTAL PROBLEMS OF DESIZING,**

Textile Chemist and Colorist, Vol. 5, No. 11, p 27-36, November, 1973.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Textiles, Pollution abatement, Oxidation, Degradation(Decomposition).

Identifiers: Desizing, \*Plasma treatment, Polyvinyl alcohol, Oxidative degradation, Fiber degradation.

The textile sizes applied to warp yarns to facilitate weaving which must be removed from the fabric before finishing greatly contribute to the pollution problems of the textile finishing industry. One of the most widely used of the synthetic sizing agents, polyvinyl alcohol (PVA), is not easily biodegraded. For this reason, a study of the use of low temperature plasma, an electrically excited form of gases at low pressure, for the removal of PVA size from fabrics was performed. Results indicate that PVA is oxidatively degraded by both oxygen and air plasmas. A significant portion of the PVA is oxidized directly to carbon dioxide and water during plasma exposure, which will reduce problems associated with the desizing operation. Fiber degradation due to this treatment is minimal and no adverse effects on fabric properties were observed. (Sandoski-FIRL)

W76-07623

**CLOSED SYSTEM AND THE MODERN TECHNOLOGY (KUROZUDO SHISUTEMU TO GENDAI GIJUTSU),**

Agency of Industrial Science and Technology, Tokyo (Japan).

T. Sakai.

Gijutsu to Kogai, (Technology and Pollution), Vol. 4, No. 1, p 14-17, January, 1975. 2 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Metals, \*Recycling, Chemical wastes, Coagulation, Oil industry, Liquid wastes. Identifiers: Zero discharge, Closed systems, Tin, Antimony.

A closed system for liquid waste treatment is being used in an electric appliance factory for its welding-plating process which uses antimony and tin. In the system, alkali is added to the plating liquid waste. Metals are coagulated and settled by sodium hydroxide. The supernatant liquid is recirculated back to the scrubber. The settled sludge is dehydrated and dissolved by hydrochloric acid. Water from the dehydration process is sent back to the supernatant liquid tank. Dissolved metals are made into salt, heated, and metal fumes are produced for the welding process. Exhaust is scrubbed, and the clean air is released while the liquid goes to the scrubber. This process recovers about half of the metal originally used in the plating process. Another example of a closed system is found at a chlorinated organic compound manufacturing plant, where liquid waste contains 4% salt and 0.15% toxic organic compounds in the amount of 1500 cu m/day. The treatment of this liquid was considered impossible until a closed system was developed. The liquid waste created by chlorination and caustification of petroleum compounds is heated and evaporated. Condensate is returned to the plant and used in the caustification process. The liquid waste is then centrifugally separated, heated, and evaporated. The distillate is sent to a process which produces glycerine. The separate solid becomes impure salt, which is heated and refined. The heat is recovered and used to form chlorine-caustic soda fume. Heated and refined salt is electrolyzed and chlorinated caustic soda fume is produced, which is used for chlorination and caustification of petroleum components. (Seigle-FIRL)

W76-07624

**WASTELESS LIQUID TREATMENT SYSTEM FOR SURFACE COATING PLANTS (HYOMEN SHORI SHISETSU NI OKERU MUHAISUI SHORI SHISUTEMU NI TSUITE),**

Y. Ikeda, T. Kokubo, and H. Oshima.

Sangyo Kogai, (Industrial Pollution), Vol. 9, No. 12, p 1205-1212, December, 1973. 11 fig, 5 tab, 8 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Metals, Ion exchange, Separation techniques, Water reuse, Recycling, Liquid wastes.

Identifiers: Chemical treatment, Surface finishing wastes, Zero discharge, Closed systems.

Surface coating processes include acid and alkaline deoiling treatment, cleansing, and neutralization; plating by zinc, tin, lead, nickel, chromium, copper, silver, and gold, singly or in combination; and, chromating. A treatment system developed for use with liquid wastes generated from these processes has been designed so that no effluents will be created, and all liquids will be circulated within a closed system. A flow chart describes the process as follows: all liquid wastes enter the scrub water tank and are then sent to the ion exchange resin treatment where liquids are classified into groups and treated separately; deionized liquid circulates back to the scrub water tank; recovered waste, newly created waste from the surface coating process, and other miscellaneous liquid waste are sent together to the chemical treatment system where liquids and solids are separated; and the separated liquid is concentrated and evaporated. Condensed water is circulated back to the scrub water tank and the solid mixes with the solid sludge from the separation process. Metals in the sludge are recovered by contracted metal refiners and reused. Problems in the system are material corrosion, noise, and its appearance. (Seigle-FIRL)

W76-07625

**LIQUID WASTE TREATMENT FOR HEAVY METALS (JUKINZOKU NO H AISUI SHORI NI TSUITE),**

E. Tatsuta.

Nenryo oyobi Nensho, (Fuel and Combustion), Vol. 41, No. 1, p 39-44, January, 1974. 2 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, Metals, Equipment, \*Heavy metals, Chemical precipitation, Chemical reactions, Liquid wastes.

Identifiers: Mitsubishi Gockel treatment system, Dyer clarifier.

After a general discussion of the principles of various treatment methods for metals containing effluents, the dyer clarifier and the Mitsubishi Gockel system are described. The dyer clarifier is a vertical structure with a rapid jet stream stirrer at the bottom, a reversed funnel shaped flocculation chamber, a funnel shaped blanket zone, a demister, and a clear water tank at the top. The sludge overflows the funnels of the blanket zone and the flocculation chamber into a sludge condensation chamber, and is discharged. The Mitsubishi Gockel system is a compact, movable system for the chemical treatment of complex industrial waste water containing various types of heavy metals in which condensation, precipitation (settling), and filtering are involved. Many unique chemical reagents are added in the process according to the type of waste liquid. The system, used basically for batch treatments of a small quantity of a highly concentrated, complex chemical waste, is a compact, high performance system that can be installed in a small space. By changing the reagent combinations, various types of liquid waste can be treated. (Seigle-FIRL)

W76-07626

#### MERCURY RECOVERY,

Belgian Patent 780222. Issued September 4, 1972. Derwent Belgian Patents Abstracts, Vol. U, No. 45, p D1, 1973.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Mercury, \*Patents, Flash distillation.

A patent has been granted for a method of mercury recovery from aqueous solutions by treating the effluents with a reducing agent and steam distilling finely divided or colloidal mercury. Finely divided or colloidal mercury is removed either by passing live steam into the solution, or by means of steam heated tubes, or by single or multistage flash distillation. The process is especially useful for removing trace quantities of mercury from exhausted brine solutions from electrolysis cells with mercury cathodes. (Sandoski-FIRL)

W76-07627

#### REVERSE-OSMOSIS SYSTEM FACILITATES DISPOSAL OF USED CUTTING OILS,

Engineers' Digest, Vol. 34, No. 10, October, 1973.

Descriptors: \*Waste water treatment, \*Industrial wastes, Oil industry, \*Waste water disposal, Legislation, Waste disposal, Fuels, Incineration, Costs, \*Oil wastes, \*Reverse osmosis.

Identifiers: Cutting oils.

Since the cutting oils employed in machining operations are generally diluted with water in a ratio of about 20:1, problems arise not only in connection with the tanking and hauling of large volumes of liquid, but also with environmental legislation regarding the disposal of cutting fluids. A new disposal system, utilizing a reverse osmosis module with a tubular configuration, has been designed to remove about 95% of the water in the oil and most of the additives. The concentrated oil can then be burnt in heating or process furnaces. The calorific value of the concentrated cutting oil, from 5,000 to 10,000 BTU/lb, provides a fuel bonus. In addition, the water and additives extracted can be used to make up new batches of

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

cutting fluid, resulting in further cost savings. (Sandoski-FIRL)  
W76-07628

**WASTE-WATER BIOCHEMICAL PURIFICATION,**  
L. P. Aleksandrova, N. Ya. Zhdanova, and A. A.  
Bondarev.  
Soviet Patent SU 372181. Issued May 4, 1973.  
Soviet Inventions Illustrated, Vol. U, No. 45, p  
D4, December, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, \*Biological treatment, \*Patents,  
\*Biochemical oxygen demand, Fungi, Filtration,  
\*Oxidation.

Identifiers: \*Microfiltration, Activated sediment.

A method has been patented for the biochemical purification of waste water through oxidation by fungus cultures and microfiltration before treatment with activated sediment. The method may be applied to industrial waste water with biochemical oxygen demand up to 4 g/liter and pH 5-6 by using *Fusarium solani* var. *argillaceum*, *Fusarium solani* var. species, and *Fusarium oxysporum*. Waste water at pH 5.5 with a BOD of 4000 mg/liter was aerated 24 hours to reduce the BOD to 1000 mg/liter (75% purification). After filtration, the water was aerated for 16 hours to produce 98.99% purification. In the first stage, 0.05-0.3 g/liter fungus was used. In the second stage 3 g/liter activated sediment was added. (Sandoski-FIRL)  
W76-07631

#### DISCONTINUOUS REMOVAL OF SOLVENT FROM POLYMER SOLUTIONS.

West German Patent DT 2050887. Issued October 25, 1973. Derwent German Patents Abstracts, Vol. U, No. 46, p A4, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, \*Chemical wastes, \*Polymers, Water  
reuse, \*Patents, Steam, Solvents.

A patent has been issued for the discontinuous removal of solvent from resinous polymer solutions in a single step. The hydrocarbon solution is mixed with water under vigorous stirring and the water is made to boil by injection of live steam. The temperature of the suspension is maintained between 70 C and the boiling point of water. The polymer solution is broken when the water-polymer ratio is maintained at 20:1-6:1. After more steam is added, the suspension is filtered, and the water (containing polymer in a ratio of less than one part polymer to 100 parts water) is recycled. (Sandoski-FIRL)  
W76-07632

#### THE TREATMENT OF SPENT PICKLE LIQUORS CONTAINING MIXED METAL CHLORIDES.

Australian Patent 441,025. Issued October 18, 1973. Official Journal of Patents, Trade Marks and Designs, Vol. 43, No. 39, p 4195, October, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, Metals, \*Patents, \*Chlorides, Continuous  
flow, Hydrolysis.

Identifiers: \*Waste pickling liquors, Counter-current  
flow, \*Metal chlorides.

A method of treating spent pickle liquors containing from 20-160 grams/liter ferrous ions, from 1-150 grams/liter zinc, and from 5-70 grams/liter hydrogen chloride has been patented. The spent pickle liquors are contacted in a continuous counter-current manner with an anion exchange medium to remove zinc chloride. The quantitative flow rates of the anion exchange medium are adjusted so that all of the zinc will be absorbed. Chloride values are recovered from the resultant chloride solution by high temperature hydrolysis. (Sandoski-FIRL)  
W76-07633

**GENERAL CONSIDERATIONS ON THE CONDITIONS OF THE ADMISSION OF INDUSTRIAL EFFLUENTS INTO WASTE WATER TREATMENT PLANTS FOR TREATMENT TOGETHER WITH URBAN WASTE WATERS, AND ON THE CONTRIBUTIONS BY THE INDUSTRIES TOWARD THE TREATMENT COSTS (VUE GENERALE SUR LES CONDITIONS D'ADMISSION DES EFFLUENTS INDUSTRIELS DANS LES STATIONS D'EQUATION, POUR TRAITEMENT EN MELANGE AVEC LES EAUX USEES URABAINES, ET SUR LA PARTICIPATION INDUSTRIELLE AU COUT DE CE TRAITEMENT),**  
D. E. Bond.

Centre Belge d'Etude et de Documentation des Eaux, Vol. 26, No. 359, p 371-377, October, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, \*Municipal wastes, Treatment facilities,  
Sewerage, Cost allocation, Water reuse, Costs.

Identifiers: Great Britain.

General conditions for the discharge of industrial waste water into municipal waste water treatment plants for treatment together with urban waste water, as well as the policy of required contribution by industries toward the treatment costs are surveyed with respect to the situation in Great Britain. According to a law enacted in 1961, local authorities have the right to specify the temperature and pH ranges of industrial waste water channeled into municipal sewer systems, and to measure its volume. Various formulae proposed for the calculation of the fees to be paid by industries for the conveyance, treatment, and disposal of their waste water include such parameters as waste water volume, BOD<sub>5</sub> and COD levels, suspended matter content, the costs of sludge disposal, and investment costs for the waste water treatment plant. For practical reasons, however, fees are calculated on the basis of the COD levels. On the other hand, industries can be effectively encouraged to reduce their water consumption and to recycle their waste water by setting an adequate price on industrial water. (Takacs-FIRL)  
W76-07634

#### EFFLUENT TREATMENT,

West German Patent DT 1560331. Issued October 25, 1973. Derwent German Patents Abstracts, Vol. U, No. 46, p F2-F3, October, 1973.

Descriptors: \*Pulp wastes, \*Waste water treatment,  
\*Industrial wastes, Pulp and paper industry,  
\*Patents, Flocculation, Lime, Hydrogen ion concentration.

An effluent treatment process for use with material from paper manufacturing has been patented. In the clarification of waste water from paper manufacturing, especially from graphic paper process, the conventional method involves adding lime and a flocculating agent such as aluminum sulfate. In this process, the effluent is treated with lime in a first stage under turbulent conditions to produce a pH greater than or equal to 9.0. The treated effluent is then passed to a second stage where the flocculant is added, lowering the pH to 6.8-8.5. (Sandoski-FIRL)  
W76-07635

**SEPARATION AND EFFLUENT TREATMENT BY ULTRASONICS,**  
Filtration and Separation, Vol. 10, No. 6, p 740, November/December, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, \*Separation techniques, \*Ultrasonics,  
Food processing industry, Screens, Pulp and  
paper industry, \*Pulp wastes.

The first commercial unit of a novel ultrasonically-assisted separation system has now been installed to process the effluent in a sand washing plant.

The system consists of a transducer array positioned underneath a sloping screen. The waste water to be treated is sprayed down the screen through a thin narrow orifice located at the top of the screen. Liquids pass through the screen, while solids travel down to be collected at its base. Experimentally approved application areas include the paper, sand, coal, and food industries. (Sandoski-FIRL)  
W76-07636

#### RECOVERY OF KRAFT WHITE LIQUOR,

D. L. Caldwell.  
Canadian Patent 937,707. Issued December 4, 1973. The Patent Office Record, Vol. 101, No. 38, p 20, December, 1973.

Descriptors: \*Waste water treatment, \*Industrial  
wastes, \*Pulp and paper industry, \*Patents, Alkalinity, Recycling.

Identifiers: \*Kraft white liquor recovery.

A patent for the recovery of Kraft white liquor has been issued. While the green liquor is causticized, calcium sulfate is added. This produces a white liquor with a higher than normal active alkali content. Sodium hydroxide may also be added to the liquor to balance added sulfur content introduced by the CaSO<sub>4</sub>. This method eliminates the need for conventional Na<sub>2</sub>SO<sub>4</sub> addition to the black liquor. (Sandoski-FIRL)  
W76-07637

#### CHLORINE DIOXIDE PULP BLEACHING SYSTEM,

R. Marchfelder.  
Canadian Patent 937,705. Issued December 4, 1973. The Patent Office Record, Vol. 101, No. 38, p 19, December, 1973.

Descriptors: \*Pulp wastes, \*Waste water treatment,  
\*Industrial wastes, Pulp and paper industry,  
\*Patents, Waste disposal, Pollution abatement,  
Chlorine dioxide, Water reuse, Recycling.

A patent has been granted for a chlorine dioxide bleaching process that improves the efficiency of bleaching paper, reduces the consumption of chemicals, water, and heat, and minimizes waste disposal problems. The process includes a two-stage system for generating chlorine dioxide. Partially spent chemicals discharged from the primary generation stage are more completely reacted under controlled conditions in a dechlorination stage. The chlorine dioxide solution from the dechlorinator is contaminated, and it must be separately collected for use in the early pulp chlorination stages. The purer chlorine dioxide from the primary generator is reserved for use in the latter stages of pulp bleaching. The chloride content and corrosiveness of the spent reagents are minimized and underflow from the dechlorinator may be added to the black liquor recovery system, increasing the recovery of sulfides. Waste disposal problems and the consumption of water are also minimized by recycling free acid from the dechlorinator to the generator. Filtrate from the last stages of pulp washing is used as the absorption media in the chlorine dioxide absorption towers. (Sandoski-FIRL)  
W76-07638

**MINIMIZING CHEMICAL AND FINES BUILDUP IN WHITE WATER BY CHEMICAL MEANS,**  
Inst. of Paper Chemistry, Appleton, Wis.

Tappi, Vol. 56, No. 12, p 144-147, December, 1973.  
8 fig., 17 ref.

Descriptors: \*Pulp wastes, \*Waste water treatment,  
\*Industrial wastes, Pulp and paper industry,  
\*Flocculation, Polyelectrolytes, Polymers, Adsorption, Coagulation.

Identifiers: Papermaking wastes, \*Coflocculation.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

The conditions necessary to minimize chemical buildup in white water of a papermaking process and to effect maximum retention of colloidal materials were examined. The coflocculation mechanism is most crucial as compared to sieving or mechanical attachment. Significant coflocculation is achieved through effecting the collapse of the electric double layers of the surface charged bodies with the provision of a suitable electrolyte concentration. The chemistry of aluminum salts in solution, the ability of its cations to effect coagulation, and the interference of complexing anions, such as sulfate, were discussed. Additional coflocculation is possible with the appropriate addition of a polyelectrolyte and the establishment of a polymer bridge. The success of the polymer retention aid is dependent upon achieving adsorption of polymer segments on the surfaces under conditions of low coverage and upon the ability of the created floc to withstand a shearing force in the process. Methods of implementing polymer adsorption and the effects of shear stress on flocculation in papermaking systems were also discussed. (Sandoski-FIRL)  
W76-07639

#### OFFENSIVE ODOR TO BE REMOVED 99% BY OJI SYSTEM, Japan Pulp and Paper, Vol. 11, No. 3, p 5, 1973.

Descriptors: \*Pulp waste, \*Waste water treatment, \*Industrial wastes, Pulp and paper industry, Odor, Equipment, Biochemical oxygen demand, Incineration.  
Identifiers: \*Japan.

Oji Paper, Japan, has developed new odor abatement equipment with the trade name 'OK Stripping'. The unit can reduce 99% of offensive odor components in the waste water of the pulp and paper industry. At the same time, the system will remove 90% of the BOD in the wastes. The air and water with undesired odors are collected and then fed to a tower. In the tower, such materials as methanol and melkabutan are gasified by steam gas blown into the tower, and then incinerated. (Sandoski-FIRL)  
W76-07640

#### LABORATORY MODEL STUDY OF THE EFFECTS ON THE AQUATIC MICROFLORA OF COAL-WASHING PLANT-GENERATED WASTE WATERS (SZENMOSO-UZEMI SZEN-NYVIZEK ELOVIZEKRE GYAKOROLT HASNAK LABORATORIUMI MODELLVIZ-SGALATA), For primary bibliographic entry see Field 5B. W76-07641

A WATER QUALITY CONTROL PROGRAM,  
Publishers Paper Co., Oregon City, Ore.  
C. Mayer, Z. Rozyczyk, and A. L. Caron.  
Tappi, Vol. 57, No. 1, p 140-142, January, 1974. 5 tab.

Descriptors: \*Waste water treatment, Pulp and paper industry, \*Industrial wastes, Suspended solids, Biochemical oxygen demand, Treatment facilities, \*Pulp wastes, \*Oregon, Water quality control.  
Identifiers: Municipal-industrial wastes, Willamette River(Ore).

Water quality conditions in the Willamette River, Oregon, required that the effluent load discharged by industrial and municipal sources be substantially reduced. Treatment systems were installed and an effective low-flow augmentation program was implemented. In-mill process changes were effected at the Newberg and Oregon City mills, first on a pilot scale and then construction over a five year period on a full plant scale. The result has been suspended solids and BOD reductions of 90 and 98%, respectively. New practices included conversion from calcium-base to magnetite pulp

production, installation of a settleable solids removal system for white water, and the addition of an aerated stabilization basin system for removal of five-day BOD from mill effluents. (Sandoski-FIRL)  
W76-07642

#### FILTRATION TECHNIQUES FOR PURIFICATION OF KRAFT PULP MILL AND BLEACH PLANT WASTES, Oak Ridge National Lab., Tenn.

J. S. Johnson, Jr., R. E. Minturn, and G. E. Moore.  
Tappi, Vol. 57, No. 1, p 134-138, January, 1975. 4 fig, 1 tab, 23 ref.

Descriptors: \*Pulp wastes, \*Waste water treatment, \*Industrial wastes, Pulp and paper industry, \*Filtration, Reverse osmosis, Membrane processes, Membranes, Water reuse, Laboratory tests.

Identifiers: Ultrafiltration, Kraft pulping wastes, Cross flow.

Laboratory tests of filtration techniques for processing various kraft pulping streams were performed. The techniques included: high-pressure hyperfiltration (reverse osmosis) with dynamic membranes rather than conventional membranes, such as cellulose acetate; moderate-pressure, low-salt-rejection ultrafiltration; and filtration of chemically treated effluents at low pressures. In each case, the feed solutions were circulated parallel to the filtering surface; the cross flow method tends to reduce concentration polarization and inhibit fouling. Effluents tested included brown-stock wash, decker, and screen-room effluents, and bleach-plant effluent. For hyperfiltration, polyacrylate membranes formed on a sublayer of hydrous Zr(IV) oxide were used. In ultrafiltration, the membranes were single layers of hydrous Zr(IV) oxide or of neutral organic polymers. While results of these laboratory tests were encouraging, further research is necessary to determine if dynamic filtration techniques can successfully be applied to in-plant wastes. Costs will be a primary factor in determining the feasibility of these approaches. (Sandoski-FIRL)  
W76-07643

#### THE PYROLYSIS OF EXTRACTED SOLIDS FROM OXIDIZED KRAFT BLACK LIQUOR AFTER LIGNIN PRECIPITATION, Lakehead University, Thunder Bay (Ontario). Dept. of Chemistry.

A. J. Bruley, W. G. Coodk, and R. A. Ross.  
Canadian Journal of Chemical Engineering, Vol. 51, No. 6, p 746-750, December, 1973. 8 fig, 4 tab, 5 ref.

Descriptors: \*Pulp wastes, \*Waste water treatment, \*Industrial wastes, Pulp and paper industry, Laboratory tests, Odor, Lignins, Chemical precipitation, Gas chromatography, Hydrogen sulfide, Analytical techniques, \*Pollutant identification.

Identifiers: \*Pyrolysis, Kraft black liquors, \*Odor control.

A laboratory investigation was conducted on the possibilities for odor reduction from kraft mill stack gases by lignin precipitation from oxidized kraft black liquor and pyrolysis of the filtrate solids. Samples of oxidized black liquor were acidified with sulfuric acid and the lignin precipitate was extracted. The extraction scheme indicates that more than 90% of the sodium in the original black liquor samples can be retained in the filtrate after lignin removal at a final pH of 2.0. The evaporated filtrate solids containing the bulk of the black liquor inorganic chemicals were pyrolyzed; the evolved hydrogen sulfide, methyl mercaptan and dimethyl sulfide were monitored by gas-chromatography. A thermogravimetric technique was used to investigate the decomposition rates of the extracted samples. These rates correlated with the levels of sulfur gases evolved

on pyrolysis. Heats of combustion were determined by bomb calorimetry. Sulfur losses from the filtrate solids and the kraft black liquor total solids were compared. Although the concentrations of organo sulfur gases from samples of lignin-extracted black liquor solids decreased through lignin precipitation, an increase in the level of hydrogen sulfide emission presents a problem for further research. (Sandoski-FIRL)  
W76-07644

#### EFFLUENT STREAM TREATMENT.

French Patent FR 2173166. Issued October 5, 1973. Derwent French Patents Abstracts, Vol. U, No. 51, p F1, January 24, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, Pulp and paper industry, Resins, Flocculation, Polymers, Coagulation, \*Pulp wastes.

An effluent stream treatment process using P-F resin solution and a water-soluble polyether was patented. Waste waters, particularly from paper and fiberboard production, were treated with a solution of a P-F resin. The resulting flocs were very rapidly coagulated in the presence of the polyether. This water-soluble compound had a molecular weight greater than 50,000 and was usually polyethylene oxide with a molecular weight greater than 100,000. Cellulose fibers could be effectively removed from effluent waters. (Sandoski-FIRL)  
W76-07645

#### PURIFICATION OF WASTE WATERS,

French Patent FR 2172935. Issued October 5, 1973. Derwent French Patents Abstracts, Vol. U, No. 50, p D7, January 17, 1974.

Descriptors: \*Pulp wastes, \*Waste water treatment, \*Industrial wastes, \*Patents, Pulp and paper industry, Suspended solids, Biochemical oxygen demand, Flocculation, Chemical precipitation, Sedimentation, Water purification.

A patented method of purification of waste papers from forest products, paper, or cardboard industries is described. The waste water consists of two parts: one having a high content of suspended matter and low content of oxygen-consuming material; and the other part having a low content of suspended matter and high content of oxygen-consuming material. Purification consisted of treating the first part to remove suspended matter. The residual liquid was then added to the second part. Precipitation agents were also added and the liquid was subjected to physical flocculation. Sedimentation and flotation products could be re-used in the process. Costs of the process and equipment were low, and small quantities of waste water could be treated. (Sandoski-FIRL)  
W76-07646

FRESH AND WASTE WATER TREATMENT BY MEANS OF REVERSE OSMOSIS AND ULTRAFILTRATION AS COMPARED WITH OR AS A SUPPLEMENT TO THE ION EXCHANGE PROCEDURE (FRISCH UND ABWASSERAUEREITUNG MIT UMGKEHRTER OSMOSE UND ULTRAFILTRATION IM VERGLEICH MIT ODER ZUR ERGRENZUNG DER IONENAUSTAUSCHTECHNIK),  
K. Marquardt.  
Oberflaeche/Surface, Vol. 14, No. 11, p 338-341, November, 1973. 5 fig, 3 tab.

Descriptors: \*Waste water treatment, \*Industrial wastes, Metals, \*Reverse osmosis, \*Ion exchange, Dyes, Membrane processes, Hydrogen ion concentration.

Identifiers: \*Ultrafiltration, \*Metal processing wastes.

Possibilities of reverse osmosis and ultrafiltration either as self-contained processes or as supplements to ion-exchange procedures in the treatment of waste waters generated by the metal processing and surface coating industries are described. Reverse osmosis is suitable for the recovery of valuable substances from effluents without the use of excess amounts of chemicals, and in a rather low temperature range. The retention of zinc from zinc chloride-containing solutions was found to increase with decreasing pH values. The nitrate ion retention, highest (80-86%) in a pH range of 7-11, is also strongly dependent on the pH value, while the retention of ammonium ions is practically independent from the pH value in a range of 3.2-6.9. The highest retention rate determined for phenol in the pH range below 10 was 55%, it increased to 95% at pH 11. Ultrafiltration, possibly combined with reverse osmosis, is suitable for the separation of dyes, tensides, and higher-molecular alcohols. Contaminant concentrations exceeding one percent require multi-stage reverse osmosis units. (Takacs-FIRL)  
W76-07647

**TREATMENT METHOD FOR HEAVY METAL CONTAINING LIQUID WASTE (JUKINZOKU GANYU HAISUI NO SHORIHO),**  
M. Nakagawa.  
PPM, Vol. 5, No. 2, p 50-56, February, 1974. 11 fig, 2 tab, 8 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Heavy metals, Iron, Evaporation, Sludge treatment, Recycling, Mercury, Adsorption, Liquid wastes.

Identifiers: \*Metal finishing wastes, Cyanides.

For effective treatment of liquid wastes produced from metal surface treatment industries, waste liquid and sludge should be grouped into four systems: ferrous acid group and alkaline cleansing; non-ferrous acid group and alkaline cleansing; chromium; and cyanides. Cyanide wastes are first degraded by oxidation. The pH is then adjusted, chromium hydroxide is settled, and the supernatant liquid is discharged. For recovery of heavy metals from sludge, a dry method or wet method is applied. For sludge with a high iron content, the dry method of chlorination evaporation is effective. Calcium chloride is added to the sludge, which is then pelletized and roasted at a temperature over 1000 °C; thus precious metals are recovered. For sludges with valuable metals other than iron, preliminary separation of metals by the wet method is desirable. First, the sludge is dissolved in sulfuric acid; or, when sludge has some iron, the iron should be suspended in water before being dissolved, and oxidized into ferric salt. Alkali is added to sulfuric acid solution and pH is adjusted to 1-2, gypsum is settled and eliminated, pH is readjusted to 3.5-4, and most iron settles in the form of basic salt. After iron is separated, the liquid is readjusted to pH 9-10, and zinc hydroxide is settled. When salt concentration is increased, the liquid can be used for producing mirabilite. If after eliminating gypsum the liquid is red in color because of a high chromium content, sulphite is added and the color is turned green; iron is settled, and zinc and chromium are settled together. Mercury-containing liquid and sludge are treated by sulfide ion, and mercury is recovered as mercury sulfide. (Seigle-FIRL)  
W76-07648

**REMOVAL OF COPPER FROM LIQUID EFFLUENTS,**  
Netherlands Patent NL 7206835. Issued November 21, 1973. Derwent Netherlands Patents Abstracts, Vol. U, No. 50, p D1, January 17, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, \*Copper, Ammonia, Activated carbon, Reduction(Chemical), Liquid wastes.

A method for removal of copper from liquid effluents by treatment with ammonia and a reducing agent is described. The effluents are treated by adding excess ammonia; adjusting the pH of the ammoniacal solution to greater than or equal to ten; and adding excess reducing agent to form a copper-containing removable sludge. Excess ammonia is added to form the copper-ammonia complex, the mixture is adjusted to pH greater than or equal to twelve with NaOH, and excess hydrazine is then added to form the sludge. After separating the sludge, the filtrate is treated with active charcoal to improve copper and excess reducing agent removal. The treated effluent may be discharged safely without danger to aquatic life or plants. (Sandoski-FIRL)  
W76-07649

#### TREATMENT OF EFFLUENTS,

French Patent FR 2174256. Issued October 12, 1973. Derwent French Patent Abstracts, Vol. U, No. 51, p D5, January, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, \*Heavy metals, Waste water disposal, Waste disposal.

A method of treating effluents containing heavy metals by a combination of high molecular compounds, concentration, and solidifying, was patented. Industrial effluents containing heavy metals in dissolved or powder form can be treated by mixing them with a liquid containing a high molecular water-soluble compound, such as polyvinyl alcohol, methyl cellulose, carboxy methyl cellulose, sodium alginate or sodium cellulose xanthate. The mixture is then concentrated by heating. After cooling, a solid layer containing the heavy metals will be produced, which is easily disposed. (Sandoski-FIRL)  
W76-07650

#### HEAVY METAL RECOVERY METHOD AND TREATMENT OF PLATING LIQUID WASTE (MEKKI HAISUICHU NO JUKINZOKU KAISHU TO SONO SHORI),

H. Okuda.  
PPM, Vol. 5, No. 2, p 44-49, February, 1974. 8 fig.

Descriptors: \*Heavy metals, \*Waste water treatment, \*Industrial wastes, Metals, Membrane processes, Membranes, Reverse osmosis, \*Ion exchange, Resins, Cation exchange, Anion exchange.

Identifiers: \*Metal finishing wastes, \*Japan, Metals recovery.

For treatment of liquid waste and metal recovery for the plating industry, the natural recirculation method, forced circulation method, single effect evaporator, multiple effects evaporator, and the steam compressor evaporator were discussed. The reverse osmosis, ion exchange resin, and condensation settling methods were compared. Reverse osmosis is still in the experimental stage in Japan. Liquid wastes containing metal salts are pressurized at 40-70 kg/sq cm and passed through a membrane.

The most widely used membrane is acetyl-cellulose; this is highly permeable for liquid and retains salt well, but it deteriorates quickly in a strong acid or strong basic solution. In a laboratory test, the nickel elimination rate for the plating liquid waste was approximately 99%; sulfuric acid radicals and chlorine ions can be eliminated up to 99%. However, the elimination of boric acid was only 30%. Therefore, when returning nickel salt to the plating bath, the boric acid content must be adjusted. In the ion exchange resin method of recovering metals, resin that has reached its exchange capacity is regenerated. For cation exchange resin, hydrochloric acid or sulfuric acid is used and for anion exchange resin, caustic soda is used. The recovery of chromium is effective by this method. When treating sludge, chromic acid solution is mixed with acid and the pH is adjusted to less than 3; sodium bisulfite is added and chromic acid is

reduced; caustic soda is added and neutralized; chromium hydroxide concentrate is then produced, which can be filtered directly. (Seigle-FIRL)  
W76-07651

#### COALESCENCE OF OLEOPHILIC LIQUID/WATER DISPERSIONS,

Netherlands Patent NL 7300380. Issued December 17, 1973. Derwent Netherlands Patents Abstracts, Vol. U, No. 50, p J1, January 17, 1974.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, Oil, \*Coalescence, \*Ion exchange, Resins, Oil pollution, Emulsions, \*Separation techniques, Dispersion, Exchangers. Identifiers: \*Oil/water separation, Oleophilic wastes.

A patented method for causing coalescence of oleophilic liquid/water dispersions using ion-exchanger beds is described. The coalescence of a dispersion of water and an oleophilic liquid is achieved by passing the dispersion through a bed of ion-exchange resin particles which have been equilibrated in relation to sorption of the oleophilic liquid. The dispersion may be one of a liquid petroleum hydrocarbon in water, and is passed upwards through the ion-exchange bed. The ion-exchange resin should be a strongly basic anion exchanger comprising quaternary ammonium groups attached to a styrene/divinylbenzene copolymer and/or a strongly acid cation exchanger comprising SO<sub>3</sub>H groups attached to a styrene/divinylbenzene copolymer. The process was especially useful for removing oil from waste waters and discharge from oil tankers. (Sandoski-FIRL)  
W76-07652

#### APPARATUS FOR REMOVING SURFACE FILMS FROM LIQUIDS,

Peabody Engineering Corp., N. Y. (Assignee). O. M. Arnold, and C. A. Vancini.  
United States Patent 3,789,586. Issued February 5, 1974. Official Gazette of the United States Patent Office, Vol. 919, No. 1, p 55, February, 1974. 1 fig.

Descriptors: \*Patents, \*Waste water treatment, Scum, Waste disposal, \*Separation techniques. Identifiers: Funnels.

An apparatus to remove surface films from liquids was patented. A funnel located below the surface of a liquid and movable across the container was placed in a reservoir. A liquid jet arranged to cause the surface film or foam to flow into the funnel from which it is discharged to the outside was also provided. (Sandowski-FIRL)  
W76-07653

#### RECOVERY OF CHEMICALS FROM SULFITE WASTE LIQUORS BY MEANS OF ELECTRODIALYSIS

(CHEMIKALIENRUECKGEWINNUNG AUS SULFITABLAUGEN MIT DER METHODE DER ELEKTRODIALYSE),  
J. N. Neponin, and B. N. Filatow.  
Zellstoff und Papier, Vol. 22, No. 11, p 331-335, November, 1973. 9 fig, 4 tab, 10 ref.

Descriptors: \*Ion exchange, \*Chemical industry, \*Industrial wastes, \*Waste water treatment, \*Laboratory tests, \*Electrodialysis, Membrane processes, Pulp and paper industry, Sulfite liquors, Recycling, Pulp wastes. Identifiers: \*Chemicals recovery.

The possibility of the chemical recovery from sodium-base sulfite liquor residues by means of electrodialysis with simultaneous fractionation of the lignosulfonic acids was studied in laboratory experiments. It was possible to recover chemicals with simultaneous fractionation of the residues from yeast recovery by electrodialysis, using ion

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

exchange membranes. The energy consumption was found to be lowest (50 kWh/kg of sodium), and the separation efficiency highest (60%) at a residue concentration of 30% dry matter, which is most probably due to a maximum of the electric conductivity of the residue at this concentration. The optimum current density was determined to be 50 ma/cm<sup>2</sup>. An increase in the residue temperature from 20 to 80°C resulted in an increase in the rate of sodium regeneration by 46 to 69%, an increase in the separation efficiency by 32 to 50%, and a decrease in energy consumption by nearly four times. To prevent backward diffusion from occurring, multi-stage operation with a maximum rate of sodium regeneration in the first stage of 74% is necessary. The increase observed in the electrophoretic mobility of the lignosulfonic acids from 1.48 to 3.84 cm<sup>2</sup>/V with a decrease in their molecular weight from 30,000 to 1,630 indicates the possibility of their fractionation in the electric field. A ten-chamber arrangement of the ion exchange membranes was preferred. (Takacs-FIRL)  
W76-07654

**GALLIUM ARSENIDE WASTE TREATMENT METHOD,**  
H. F. Bell, and G. Calley.  
IBM Technical Disclosure Bulletin, Vol. 16, No. 8, p 2649, January, 1974.

Descriptors: \*Industrial wastes, \*Waste water treatment, Alkalinity, Liquid wastes, Chemical precipitation, Filtration, Chemical wastes.  
Identifiers: \*Gallium arsenide treatment, \*Arsenic removal, Gallium.

The use of standard treatment procedures on waste gallium arsenide solutions did not result in consistent arsenic removal, and removed only 15% of the gallium in the waste. The following procedure takes into account the presence of hypochlorite and carbonate in the waste liquid, which cause the erratic results when the waste is treated in the conventional manner. First, alkaline waste is treated with 30% hydrogen peroxide to destroy all sodium hypochlorite present. Concentrated hydrochloric acid is then added to lower the pH to four, after which the solution is allowed to stand (with agitation) until the carbonate decomposes. The pH is then raised with lime (pH about 12) to precipitate the gallium and arsenic. Ferric chloride is added at this point to aid in the precipitation process. Finally, the material is filtered. (Sandoski-FIRL)  
W76-07655

**IN-PLANT WASTE ABATEMENT,**  
Allied Chemical Corp., Morristown, N.J.  
W. M. Reiter, and W. F. Stocker.  
Chemical Engineering Progress, Vol. 70, No. 1, p 55-59, January, 1974. 7 fig, 1 tab.

Descriptors: Chemical industry, \*Waste water treatment, Lagoons, Suspended solids, \*Recycling, Effluents, Treatment facilities, \*Industrial wastes, Water reuse, \*Chemical wastes, Mississippi River.  
Identifiers: Alum, Phosphoric acid, Hydrofluoric acid, Zero discharge.

Allied Chemical has eliminated waste discharges from an alum plant, and is currently evaluating techniques for achieving zero discharge from its phosphoric acid and hydrofluoric acid facilities. To reduce discharge into the Mississippi River near New Orleans, a two-pond containment system was installed, pumping wastes to the first lagoon where suspended solids are removed, then to the second which functions as a clear well. The water goes back into the process as make-up for subsequent batches, completing a closed-loop operation. A recycling method for transport water used in HF manufacture involves neutralization of slurry and scrubber effluent; another treatment method being used in HF manufacture is dry han-

dling of the HF furnace residue with concomitant elimination of aqueous waste. In the manufacture of phosphoric acid for fertilizer applications, acidulation of tricalcium phosphate is the main reaction. Acid water effluent from the process may be recycled with a 96% effectiveness. (Sandoski-FIRL)  
W76-07656

**INDUSTRIAL WASTE WATER TREATMENT.**  
Belgian Patent BE 799901. Issued January 24, 1974. Derwent Belgian Patents Abstracts, Vol. U, No. 51, p D2, January, 1974.

Descriptors: \*Patents, \*Industrial wastes, \*Waste water treatment, \*Electrolytes, Electrodes, Heavy metals.  
Identifiers: \*Cyanides, Electrolytic cells.

A patent for industrial waste water treatment using an electrolytic cell, applicable to the extraction of cyanides, was granted. A number of rows of parallel bar auxiliary electrodes are located between principal parallel plate electrodes. These form two side walls of the cell and increase the effective area of the electrochemical active surface. Thus, the voltage applied can be reduced, giving a higher efficiency due to reduction of gases. The bars are alternate carbon for the extraction of the cyanide, and a metal alloy which electrically dissolves the hydroxide of its own metals. Heavy metal ions are therefore extracted, and supported in an open box structure. (Sandoski-FIRL)  
W76-07657

**THE CONSTRUCTION OF AN INDUSTRIAL WASTE WATER DISCHARGE PIPE SYSTEM INTO THE SEA (BAU EINER INDUSTRIEABWASSER-LEITUNG INS MEER),**  
For primary bibliographic entry see Field 5E.  
W76-07658

**PLASTIC FILTERS FOR THE PURIFICATION OF DAIRY PRODUCT PROCESSING-GENERATED WASTE WATERS (KUNSTSTOF FILTER-MODULEN VOOR DE ZUIVERING VAN AFVALWATER, AFHOMSTIG VAN DE ZUIVELVERWERKING),**  
M. L. Hemming.  
Voedingsmiddelentechnologie, Vol. 4, No. 47, p 34-35, November 21, 1973. 1 fig, 1 tab.

Descriptors: \*Food processing industry, \*Waste water treatment, \*Biochemical oxygen demand, \*Filters, Equipment, Plastics, Oxidation, Activated sludge, Industrial wastes, \*Dairy industry, Filtration.  
Identifiers: Polyvinyl chloride, Biofilters, BOD5.

The suitability and use of filter modules made of plastic materials for the purification of dairy-generated waste waters with high BOD5 loads are described. While older designs were made mostly of polyethylene, the modules are now made of polyvinyl chloride. Plastic filter modules are suitable for the treatment of dairy-generated waste waters in oxidation towers (percolation filters), and in conventional activated sludge units. For the percolation filters, the minimum input capacity is 1.47 cu m/sq m/h. Oxidative filtration by means of plastic filter modules can reach efficiencies of 90% or more in terms of BOD5 reduction. (Takacs-FIRL)  
W76-07659

**NEW ULTRAFILTRATION SYSTEM USES INORGANICS.**  
Chemical Engineering News, Vol. 52, No. 4, p 24-25, January 28, 1974. 1 fig.

Descriptors: \*Membrane processes, \*Industrial wastes, \*Waste water treatment, Polymers, Food processing industry, Algal control, \*Inorganic compounds, Economics, Carbon.  
Identifiers: \*Ultrafiltration, Ucarsep process.

Union Carbide has incorporated inorganic substances into its commercial ultrafiltration system called Ucarsep. Ucarsep consists of standard modules made up of bundles of porous carbon tubes coated on the inside with a series of inorganic compositions. The standard module is six inches in diameter and contains 151 tubes four feet long with a total working area of 37.5 square feet and daily production of 2,000 to 5,000 gallons of filtrate. Among its useful characteristics are ability to: process particles in the size range of 10 to 50 angstroms, and large polymer molecules of 10,000 to 50,000 molecular weight; and process material up to 200°F, at a pH of 2 to 14, and a feed pressure of 600 p.s.i. Future applications include cheese whey protein recovery, latex concentration, detergent solution reuse, water recovery from black liquor, and algae removal. (Sandoski-FIRL)  
W76-07660

**METALFINISHING GETS AN ECOLOGICAL BOOST,**  
R. R. Irving.  
Iron Age, Vol. 213, No. 5, p 50, February 4, 1974. 1 fig.

Descriptors: \*Metals, Water pollution control, \*Filtration, \*Membrane processes, \*Waste water treatment, Installation, Oil wastes, Carbon, Inorganic compounds, Pre-treatment(Water).  
Identifiers: \*Ultrafiltration, Ucarsep system, Metalfinishing wastes.

A new ultrafiltration process has been developed by the Union Carbide Corporation, called Ucarsep. The unit consists of carbon tubes, and the inner diameter of each tube is coated with an inorganic membrane. The process has been successful in treating wastes found in metal-working, particularly automotive and appliance manufacturing, and in coil coating. The system is being used on production lines for removal and concentration of oil from pre-paint detergent cleaning baths, oily waste streams and phosphating cleaning lines. Oil is removed from a cleaning solution before it reaches the waste water treatment system. The typical 6000 gpd Ucarsep system, including pumps, controls, and modules can be mounted on a 2 ft by 4 1/2 ft base, and payback will range from less than six months to two years. (Sandoski-FIRL)  
W76-07661

**EFFECT OF TEMPERATURE ON CANNERY WASTE OXIDATION,**  
North Texas State Univ., Denton. Dept. of Microbiology.  
G. R. Vela.  
Journal Water Pollution Control Federation, Vol. 46, No. 1, p 198-203, January, 1974. 2 fig, 2 tab, 5 ref.

Descriptors: \*Food processing industry, \*Waste water treatment, \*Waste disposal, \*Biological treatment, Environmental effects, Irrigation, Microorganisms, Temperature, Bacteria, \*Oxidation.  
Identifiers: \*Land disposal, Living filter system, Spray irrigation.

A spray irrigation waste disposal system developed by the Campbell Soup Company at Paris, Texas, was examined. Wastes from food processing (the cannery) are discharged into the soil, with a retention time of about 24 hours. Purification is the result of microbiological activity in the disposal field. The relationships between temperature, the growth of bacteria in soil, and oxidation of the waste water were illustrated. It was determined that the soil in the area of the disposal field had an autochthonous bacterial population, including obligate psychrophiles and obligate thermophiles. While these organisms contribute to the oxidative degradation of the plant waste water at extremes of temperature, the major portion of the oxidative capacity of the soil microflora came from the metabolic activities of the mesophilic

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

bacteria. The system, therefore, functions over a wide range of temperatures. (Sandoski-FIRL) W76-07662

#### **MUDY WATER TREATMENT SYSTEM FOR AGGREGATE PLANT, (IN JAPANESE), H. Ishii, and F. Komatsu.**

Kobe Steel Engineering Reports, Vol. 24, No. 1, p 122-126, January, 1974. 7 fig, 3 tab.

Descriptors: \*Mining, \*Filters, Liquid wastes, Pilot plants, \*Waste water treatment, Chemical precipitation, \*Industrial wastes, Aggregates, Dewatering.

Identifiers: Japan.

Muddy water treatment in a closed system for the spiral classifier overflow of an aggregate crushing plant is described. The pollutants are the clay, top soil, and microparticle rock powder crushed in various crusher machines of the plant, more than 90 percent of which are less than 200 mesh (0.074 mm) particles. The concentration of solid in the liquid is extremely high (30,000-70,000 ppm). The solid amounts emitted are 1.5 tons per hour to 50 tons per hour at peak times. This creates a tremendous amount of slurry requiring precipitation and dehydration treatment. The precipitation separation divides the liquid into 20-40 percent slurry and supernatant liquid; slurry is then made into 50-80 percent solid cake by the dehydrator. Equipment of the closed muddy water treatment system designed by Kobe Steel, Japan, was described. The liquid waste treated in this completely closed system is never discharged outside the plant. Results of a preliminary test and the pilot plant were presented in tables and graphs. (Seigle-FIRL) W76-07664

#### **MAGNETIC SEPARATIONS NEAR MARKET BREAKTHROUGH.**

Chemical and Engineering News, Vol. 52, No. 4, p 21-24, January 28, 1974.

Descriptors: \*Pulp wastes, \*Separation techniques, Pulp and paper industry, \*Industrial wastes, \*Waste water treatment, Potable water, Viruses, Magnetic studies, Steel.

Identifiers: High gradient magnetic separation (HGMS), \*Magnetic separation.

High-gradient magnetic separation (HGMS) is a new and promising technology which may prove to be applicable in a wide variety of fields. The first and only commercial application of HGMS was in the clay industry. However, successfully tested HGMS units have been used in connection with paper mills, steel mills, and other industrial plants. Nonmagnetic impurities in effluents can be separated to form magnetic agglomerates. Also, a cooperative effort by Harvard and MIT is being undertaken to remove viruses from drinking water by HGMS. (Murphy-FIRL) W76-07665

#### **A SOLUTION OF TRANSIT PROBLEMS ARISING IN PIPES CARRYING ENCRUSTATING AND SEDIMENTATING WASTE WATERS (LOESUNG VON TRANSPORTPROBLEMEN BEI INKRUSTIERENDEN UND SEDIMENTIERENDEN ABWASSERN IN ROHRLEITUNGEN), W. Kuhn.**

Gas-Wasserfach/Wasser-Abwasser, Vol. 114, No. 11, p 530-537, November, 1973. 11 fig, 7 ref.

Descriptors: \*Pipes, \*Pipelines, \*Sewers, \*Tannery wastes, \*Waste water treatment, Cleaning, Treatment facilities, Odor, Economics, Industrial wastes.

Identifiers: \*Leather factory wastes.

A solution to the problem of the conveyance of leather factory waste waters carrying encrusting and sedimenting materials in pressurized sewer

pipes to a waste water treatment plant is described. Since an open sewer was unsuitable due to malodorous emissions from the effluents, pressurized sewer pipe with an inner diameter of 500 mm was chosen. To prevent encrustation and sedimentation inside the sewer pipes, these pipes were designed for regular cleaning by means of sewer scraper. Sewer scraping proved to be both economical and reliable. (Takacs-FIRL) W76-07666

#### **TREATING INDUSTRIAL WASTE WATER.**

Belgian Patent BE 799386, Issued January 3, 1974. Derwent Belgian Patents Abstracts, Vol. U, No. 48, p D1, January, 1974.

Descriptors: \*Pulp wastes, \*Patents, \*Industrial wastes, \*Waste water treatment, Pulp and paper industry, Chemical precipitation, Cellulose, Pretreatment(Water), Tannery wastes, Textiles, Filters.

A new method of treating industrial waste water with a cellulose-containing precipitating agent is described. Waste water is purified by contacting it with a cellulose-containing absorbing material which has been pretreated with a precipitating agent. The cellulose is generally in the form of a filter, pretreated with a polyaniconic precipitating agent such as a dicyandiamide-formaldehyde or dicyandiamide urea-formaldehyde condensation product, alkylene polyamines or dipolyamidopolyamides made by reacting polymerized fatty acids with polyamines. The products are useful for removing impurities such as anionic dyes or optical bleaches from spent baths in the textile, paper and leather industries. (Murphy-FIRL) W76-07667

#### **THE SCAM (THE ENTERPRISES OF THE ELECTRO-MECHANICS COMP) AND THE RECYCLING OF INDUSTRIAL WATERS (LA SCAM ET LE RECYCLAGE DES EAUX INDUSTRIELLES).**

Industries Alimentaires et Agricoles, Vol. 90, No. 9/10, p 1307, September/October, 1973. 1 fig.

Descriptors: \*Industrial wastes, \*Waste water treatment, \*Recycling, Cooling water, \*Water reuse, Water consumption.

Identifiers: Zero discharge.

Equipment for the cooling of industrial waste waters to be recycled is described. The atmospheric cooler operating in a closed cycle, and providing for direct contact between the waste water to be cooled and the air, has a water consumption amounting to only 2% of that of an open-cycle cooler. The minimum capacity of the unit lies at 70 cu m/h. Water consumption, and also direct contact between the water and the air can be fully suppressed by the use of another cooler composed of finned tube bundles. (Erdelyi-FIRL) W76-07668

#### **TERRITORY, INDUSTRIAL PLANTS, WATER SUPPLY, AND WASTE WATER PLANTS-PARTNERS IN JOINT INVESTMENTS (TERRITORIUM, INDUSTRIEBETRIEBS UND VEB WAB-PARTNER GEMEINSAMER INVESTITIONEN), F. Dimitrovici.**

Wasserwirtschaft-Wasserwissenschaft, Vol. 23, No. 12, p 423-426, 1973. 2 fig, 2 ref.

Descriptors: \*Waste water treatment, Water supply, \*Industrial wastes, \*Biological treatment, Sludge treatment, Economics, Flocculation, Water treatment, Water purification.

Identifiers: Municipal-industrial wastes, Dyeing wastes, Chemical treatment.

A large dyeing plant and the public authorities for water supply and communal water purification in

Erfurt, Germany, agreed on the joint treatment of the dyeing waste water along with domestic waste water for economical reasons. The following process stages were selected: balancing of the concentration of the dyeing waste water in the factory; mechanical and chemical purification of the dyeing waste water along with the domestic waste water; and sludge treatment and drying. The domestic waste water carries an organic load of 200 to 300 mg/liter; the industrial waste water after discoloration, 600 to 800 mg/liter at a temperature of 30 to 45°C. For mechanical purification, a long sand trap with hydromechanical removal of the solid matter was selected. For chemical purification, magnesium chloride lye is added for flocculation. Through addition of lime milk the pH of the waste water is raised from less than seven to more than ten. A uniform temperature of less than 35°C is maintained throughout this process. The sludge from chemical treatment is dehydrated and then dried in drying beds. Of the 60 drying beds, 55 are used for industrial sludges and five for domestic sludges. The biological stage is supplied with waste water from the mechanical and chemical stages, and comprises three basins. (Erdelyi-FIRL) W76-07669

#### **DEVELOPMENT OF DESIGN GUIDELINES FOR SHIPBOARD SEWAGE HOLDING TANKS.**

Abatement and Compliance Branch, Water Pollution Control Directorate Environmental Protection Service, Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-76-3, March, 1976, 101 p., 25 fig., 7 tab, 28 ref.

Descriptors: \*Ships, \*Design, \*Sewage treatment, Operation and maintenance, Great Lakes, St. Lawrence River, Domestic wastes, Aerobic bacteria, Effluents, Sludge, Suspended solids, Waste water(Pollution), Costs, \*Canada, Treatment facilities, Waste water treatment.

Identifiers: \*Sewage holding tanks, Vessels, Grey waters, Flush waters.

A detailed study is presented of shipboard sewage holding tanks suitable for vessels engaged on the Great Lakes - Lower St. Lawrence River trade route. A range of designs has been developed to meet the needs of most ship types, crew sizes, trading patterns, stability criteria and sewage collection systems. Construction, operation, maintenance and safety aspects are analyzed with a view to optimizing the economic impact on vessels that choose total retention as a method of satisfying the requirements of the Great Lakes Sewage Pollution Prevention Regulations. (Environment Canada) W76-07677

#### **SLUDGE INCINERATION AND PRECIPITANT RECOVERY, VOLUME I, A SELECTIVE CODED BIBLIOGRAPHY,**

Department of the Environment, Ottawa (Ontario).

For primary bibliographic entry see Field 5E. W76-07678

#### **DEVELOPMENT OF DESIGN GUIDELINES FOR SHORE-SIDE HOLDING TANKS.**

T. A. Constantine, and P. J. Osmond. Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-76-2, January, 1976, 48 p, 4 fig, 1 tab, 3 ref.

Descriptors: \*Design criteria, \*Ships, Sewage, \*Sewage treatment, Water pollution, Design, Capital costs, Operation and maintenance, Economics, Cost-benefit analysis, Water pollution sources, \*Waste water treatment, \*Treatment facilities.

Identifiers: \*Holding tanks, Environmental protection.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

Requirements for shore-side holding tanks receiving sewage collected on board vessels are discussed. Preliminary designs for a basic system and two variations are developed and capital cost estimates are presented. Operating procedures are outlined and estimated annual operating costs for the shore-side holding tank installations are provided. The main conclusion is that properly designed holding tank facilities will be very expensive to construct and operate and that, if possible, direct transfer of the sewage from the vessel to a shore-side sewer or treatment facility should be undertaken. If holding tanks are required, the system denoted as Alternative No. 3 is probably the most acceptable. (Environment Canada) W76-07681

#### INVENTORY OF CANADIAN COMMERCIAL SHIPS ON THE GREAT LAKES.

Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Ottawa, Canada, Economic and Technical Review Report EPS 3-WP-76-1, January, 1976, 62 p., 17 fig., 7 tab., 2 append.

Descriptors: \*Water treatment, \*Waste water treatment, \*Ships, Water pollution sources, \*Great Lakes, Design criteria, Operation and maintenance, Prototypes, Testing, Model studies, On-site investigations, Systems analysis, \*Canada. Identifiers: Flow equalization, Carbon adsorption, Bio-oxidation, Clarification, Multimedia filtration, Ozonation.

Data contained in replies to questionnaires submitted to shipping companies are analyzed. The questionnaires were designed to produce an inventory of Canadian commercial ships operating in the Great Lakes / St. Lawrence Seaway region, their operating companies, the major characteristics of each ship, and the extent of vessel waste control problems in the area under study. A statistical breakdown of the questionnaire replies was made in an attempt to provide numerical data which may prove useful for other related studies. (Environment Canada) W76-07682

#### SELECTED BIBLIOGRAPHY ON OZONE DISINFECTION,

Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.

A. Netzer, and H. K. Miyamoto.

Canada-Ontario Agreement on the Great Lakes Water Quality, Research Report No. 29, Training and Technology Transfer Division (Water), Environmental Protection Services, Environment Canada, Ottawa, Canada, February 1976, 62 p.

Descriptors: \*Bibliographies, \*Ozone, Water purification, Water treatment, Potable water, Disinfection. Identifiers: Ozone disinfection.

A selected bibliography of about 500 references on ozone disinfection has been compiled. References are listed in alphabetical order and a subject-author index is included. (Environment Canada) W76-07683

#### FACTORS AFFECTING ACTIVATED SLUDGE TREATMENT OF KRAFT BLEACHERY EFFLUENT,

Department of the Environment, Ottawa (Ontario).

P. H. M. Guo, W. K. Bedford, and B. E. Jank.

Technology Development Report EPS 4-WP-76-1, 22nd Annual Ontario Industrial Waste Conference, Toronto, February 1976, 30 p., 11 fig., 7 tab., 16 ref.

Descriptors: \*Sludge treatment, \*Effluents, \*Pulp and paper industry, \*Treatment facilities, Waste water(Pollution), Sludge, Temperature, Aeration,

Toxicity, Suspended solids, Bleaching wastes, Hydrogen ion concentration, \*Waste water treatment.

Identifiers: Bleacheries, Detoxification, Kraft bleachery effluents, Sludge flocs, Nutrient addition, Pulp and paper mills.

Although activated sludge systems are used in the treatment of pulp and paper mill effluents, many factors which could affect their design and operation have not been identified. Extensive bench scale and pilot scale experimentation involving activated sludge treatment of kraft bleachery effluent have revealed a number of important factors related to the performance of the treatment systems. Bioassays carried out to investigate factors affecting the toxicity of kraft bleachery effluent during storage indicated that toxicity reduction was closely related to the sample pH. There was a significant detoxification of neutralized bleachery effluent samples during an eleven-day storage period. Aeration enhanced the rate of detoxification but the influence of storage, temperature and nutrient addition was negligible. Temperature significantly affected the concentration of effluent suspended solids of activated sludge systems treating kraft bleachery effluent. The study demonstrated that deterioration of effluent quality occurred at operating temperatures equal to or greater than 35°C. Increased effluent suspended solids were related to a continuous rising of pin-point flocs which was considered to be partially due to a temperature gradient in the clarifier. Elimination or inversion of the temperature gradient in the clarifier was successful in controlling the pin-point floc problem. (Environment Canada) W76-07684

#### 'CABOS' - NEW WASTEWATER TREATMENT SYSTEM FOR VESSELS,

Ontario Research Foundation, Sheridan Park, H. Lomas, and A. R. Townshend.

Water Pollution Control Directorate, Environmental Protection Service, Environment Canada, Ottawa, Canada, Technology Development Report EPS 4-WP-76-2, February, 1976, 66 p., 12 fig., 15 tab., 9 ref., 2 append.

Descriptors: \*Waste water treatment, \*Ships, Water pollution sources, Great Lakes, Design criteria, Operation and maintenance, Prototypes, Testing, Model studies, On-site investigations, Systems, \*Canada.

Identifiers: Flow equalization, Carbon adsorption, Bio-oxidation, Clarification, Multimedia filtration, Ozonation.

A system was designed for the treatment of black and grey water from commercial vessels to meet effluent quality requirements for undiluted discharge into the Great Lakes and other water bodies. Laboratory units and pilot plant models were constructed at the Ontario Research Foundation and tested under simulated shipboard conditions. The results of these tests were used in the design of a prototype unit which was constructed and installed aboard the SS John A. France, a bulk carrier owned and operated by Scott Misener Steamships Limited. The system incorporates flow equalization, carbon adsorption bio-oxidation, clarification, multimedia filtration, and ozonation. It is called the CABOS system. Operations such as cleaning of the clarifier and backwashing of the filter are controlled automatically. Field testing and system evaluation under actual shipboard conditions will be undertaken during the 1975 sailing season. (Environment Canada) W76-07685

#### TWO TRILLION OR THREE: THE COST OF WATER QUALITY GOALS,

New York State Dept. of Environmental Conservation, Albany.

For primary bibliographic entry see Field 5G. W76-07686

#### COST EFFECTIVENESS OF REGIONAL WATER QUALITY MANAGEMENT: SOME SELECTED CASE STUDIES AND GENERAL IMPLICATIONS,

Manhattan Coll., Bronx, N. Y. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G. W76-07687

#### FINANCING AND CHARGES FOR WASTEWATER SYSTEMS: ACTIVITIES OF THE JOINT WPCF/ASCE/APWA COMMITTEE,

Hazen and Sawyer, New York.

For primary bibliographic entry see Field 5G. W76-07689

#### DYNAMICS OF THE PURIFICATION OF DOMESTIC FECAL SEWAGE ON SEWAGE FARMS (IN RUSSIAN),

Nauchno-Issledovatel'skii Institut Epidemiologii, Mikrobiologii i Gigieny, Vilnius (USSR). A. K. Baubinas, and V. V. Vlodavets. Gig Sanit. 4, p 100-101, 1974.

Descriptors: \*Sewage treatment, \*Waste water treatment, Domestic wastes, \*Sprinkling irrigation, Salmonella, Shigella, \*Pathogenic bacteria, Epidemiology, Drainage, Water purification. Identifiers: Salmonella-Eastbourne, Salmonella-Heidelberg, Shigella-Sonnei.

The dynamics of purification of domestic sewage on sewage farms with overhead sprinkling irrigation was studied. The most intense purification of sewage from chemical and bacterial contaminants occurs within the 1st hours after irrigation. Reliable purification of the sewage from pathogenic microorganisms (Salmonella eastbourne, Salmonella heidelberg, Shigella sonnei) is not provided in the case of overhead irrigation at a rate of 350 m<sup>3</sup>/ha on the sewage farms during maximum runoff of the drainage water, and the discharge of such runoffs into surface waters is epidemiologically hazardous. A decrease of the irrigation rate, increase of the filtering layer of soil and reuse of the drainage runoffs would promote an increase of the effectiveness of treating sewage on sewage farms.—Copyright 1975, Biological Abstracts, Inc. W76-07692

#### METHOD OF ELECTROLYTIC TREATMENT OF WASTE WATER,

Mitsui Mining and Smelting Co. Ltd., Tokyo(Japan). (Assignee).

M. Ishii, and M. Ichiki.

United States Patent 3,783,114. Issued January 1, 1974. Official Gazette of the United States Patent Office, Vol. 918, No. 1, p 415, January, 1974. 1 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Patents, \*Electrolysis, Heavy metals, Electrolytes, Electrodes, Oil wastes, Anodes, Cathodes.

A patent has been granted for a method of electrolytic treatment of industrial waste water. The electrolysis is conducted by introducing the industrial waste water as the electrolyte into an electrolytic cell equipped with vertically suspended anodes and horizontal cathodes positioned near the bottom of the cell. The scum arising from the electrolysis of the heavy metal ions, fats and oils including animal, vegetable and mineral oils, various fine, solid floating matters is removed from the upper part of the electrolytic cell. The electrolytically purified waste water is removed from the lower part of the electrolytic cell. (Sandoski-FIRL) W76-07707

#### STUDIES ON THE TREATMENT OF WASTE-WATER FROM FOOD PLANTS WITH ACTIVATED CARBONS. PART I. MODEL EX-

**PERIMENTS ON ADSORPTION OF TYPICAL ORGANIC COMPOUNDS, (IN JAPANESE),**  
National Food Research Inst., Tokyo (Japan).  
M. Sugimoto, M. Takagi, and H. Yoshii.  
Nippon Shokuhin Kogyo Gakkaishi, (Journal of Food Science and Technology), Vol. 20, No. 7, p 229-303, 1973. 7 fig, 1 tab, 16 ref.

**Descriptors:** \*Adsorption, \*Activated carbon, \*Organic compounds, \*Food processing industry, \*Waste water treatment, Model studies.

**Identifiers:** Freundlich adsorption isotherm, Starch.

The adsorption capacity of activated carbons was evaluated using several kinds of organic substances. Adsorption capacity and rate were represented by the Freundlich adsorption isotherm. For powdered activated carbons 1/h values were as follows: phenylalanine 0.2-0.3; soluble starch and methionine 0.4-0.6; glucose 0.5-0.6; lactic and glutamic acid 0.6-1.0; and, polypropylene 1.3-1.8. And for granular activated carbons these values were: phenylalanine 0.3; lactic acid, methionine, glutamic acid and glucose 0.5-0.7; polypropylene 1.0-1.4; and, soluble starch 0.37 and 2.84. The amount of activated carbons required for removal of those solutes to 80 percent level in 100 ml solution, showed the lowest value (0.5-0.9 g) in case of phenylalanine with both powdered and granular carbons, and the highest value (above 10 g in case of soluble starch) with granular carbon. (Murphy-FIRL)

W76-07708

**DECHLORINATION OF MUNICIPAL SEWAGE USING SULFUR DIOXIDE,**  
International Pacific Salmon Fisheries Commission, New Westminster (British Columbia).  
For primary bibliographic entry see Field 5C.

W76-07715

**AN ACTUAL EXAMPLE OF WASTE WATER TREATMENT IN A PETROLEUM FACTORY,**  
H. Tada.

In: Proceedings of the 1974 All-Japan Pollution Control Technical Conference, Tokyo, Japan, June 10-14, 1974. p 11-20, 6 fig, 6 tab.

**Descriptors:** \*Waste water treatment, \*Industrial wastes, \*Oil wastes, Treatment facilities, Polymers, Aeration, Activated sludge, Biological treatment, Costs, Maintenance, Biochemical oxygen demand, Suspended solids.

**Identifiers:** Petroleum factory wastes.

The first stage of the Oita petrochemical complex was completed in June of 1969 with the construction of the ethylene center and annual production of 150 kt ethylene. The liquid waste produced in this complex comprises waste water from the monomer, polymer, cracker, and utility plants. With the exception of the monomer plant, which is acidic, the others are neutral; suspended substances are high in the polymer and utility plants; oil is high in the cracker plant; and BOD is high in the monomer and cracker plants. Pressure flotation treatment is applied to the waste water from the polymer and cracker plants, and a further biological treatment is given to the latter. Utility water is treated by settling, and waste water from the monomer plant is neutralized and then biologically treated. For biological treatment, one system uses an aeration activated sludge tank while the other uses a UNOX activated sludge tank. UNOX aeration, with a high purity oxygen atmosphere, can tolerate heavy loads and concentration shocks. UNOX can treat a load of BOD-SS about three times heavier than normal with 2-3 times more BOD volume and still achieve 99% BOD removal. The maintenance, measurement and analysis methods, treatment costs, and future expansion plans of this water treatment system were also discussed. (Seigle-FIRL)

W76-07717

**METHODS AND COSTS OF INDUSTRIAL EFFLUENT TREATMENT,**  
Ciba-Geigy Limited, Duxford, Cambridge, Environmental Technical Services Group.  
K. G. Singleton.  
Chemistry and Industry, No. 6, p 233-237, March 20, 1976. 1 fig, 5 tab, 7 ref.

**Descriptors:** \*Chemical industry, \*Waste water treatment, \*Industrial wastes, Waste discharge, Economics, Water pollution control, Effluents, Plastics, \*Costs, Design, Treatment facilities.  
**Identifiers:** \*Synthetic resin industry wastes.

Economics have become a significant criterion in the evaluation of industrial effluent treatment in Great Britain. In the synthetic resin industry, the Duxford site of the Plastics Division of Ciba-Geigy (UK), Limited, has designed its treatment facilities from an economic standpoint. Waste waters from the factory contain methanol for maldehyde, and phenol, as well as traces of resin in solution and suspension. These organic effluents are diluted, and domestic sewage from the neighboring area is added. The combined wastes are pumped from a storage lagoon to a completely mixed activated sludge plant. Air is supplied by a mechanical surface aerator. Primary activated sludge is followed by secondary activated sludge and biological filters in parallel. Excess cooling water from the factory is used for dilution of the treated effluent before discharge into the River Cam. In order to treat the chemical wastes most economically, all new products are evaluated at the laboratory bench and any byproducts are considered for possible recycling. Waste materials are analyzed and a pollution load factor is established as a percentage of the existing load to the effluent treatment plant. With Duxford's policy of reclamation before degradation, savings in recovered raw materials have accounted for almost two times the annual operating costs for the plant. (Kramer-FIRL)

W76-07740

**EXTRACTION OF (NITRO-) PHENOLS FROM AQ. STREAM USING NITROBENZENE,**

Belgian Patent BE 830-558. Issued December 24, 1975. Derwent Belgian Patents Abstracts, Vol. X, No. 2, p D3, February, 1976.

**Descriptors:** \*Phenols, \*Nitrogen, \*Patents, \*Waste water treatment, \*Chemical wastes, Chemical industry, Water pollution sources, \*Industrial wastes, Separation techniques.

A method for treating effluents from the production of nitrobenzene by reaction of benzene with HNO<sub>3</sub>/H<sub>2</sub>S0<sub>4</sub> has been patented. The process is used for the separation of mono- and tri-nitrophenols, phenol, cresol, xylenol, resorcinol, pyrogallol, and tetrahydroxy-benzenes. Phenol or nitrophenol may be extracted from the aqueous stream by completely mixing nitrobenzene with the aqueous stream, where the pH of the water contained in the mixture is below 5 and the ratio of nitrobenzene to phenols is at least equal to the saturation ratio. This mixture is then separated into a raffinate containing water free of phenols and an extract containing the phenols dissolved in nitrobenzene. This extraction is accomplished at 5 to 75°C. (Kramer-FIRL)

W76-07741

**OZONE WITH ULTRAVIOLET LIGHT PROVIDES IMPROVED CHEMICAL OXIDATION OF REFRACTORY ORGANICS,**  
Houston Research Inc., Tex.

C. E. Mauk, and H. W. Prengle, Jr.  
Pollution Engineering, Vol. 8, No. 1, p 42-43, January, 1976. 2 fig, 1 tab.

**Descriptors:** \*Ozone, \*Organic compounds, \*Waste water treatment, \*Ultraviolet radiation, Oxidation, Industrial wastes.  
**Identifiers:** \*Cyanides.

Previous research on the combination treatment by ozone and UV to destroy cyanides has been quite successful. For example, the U.S. Air Force has designed and is building a full scale prototype to reduce complexed cyanide from 50,000 mg/liter to a total cyanide concentration below limits of detection in electroplating waste water. A more recent use of ozone-UV treatment is in the oxidation of refractory organic compounds in secondary waste water effluents. In this investigation, ethanol, glycerol, acetic acid, glycine, and ammonium palmitate were chosen for treatment. Concentration of 100 mg/liter and lower were treated with ozone-UV in deionized water; typical removal curves are provided. Data on ozone autodecomposition, mass transfer, and reaction rates have also been collected. The use of UV with ozone enhanced the reaction until it offset the effect of greater ozone autodecomposition; the TOC of all the test solutions were quickly reduced to below the detectable limit. (Kramer-FIRL)

W76-07742

**WASTE WATER TREATMENT IN PAINT WORKS,**  
G. Coppa-Zuccari.

Polymers, Paint and Colour Journal, Vol. 166, No. 3916, p 114-115, February 11, 1976. 3 tab.

**Descriptors:** \*Chemical wastes, \*Waste water treatment, \*Treatment facilities, \*Paints, \*Chemical industry, Color, Oil wastes, Industrial wastes.  
**Identifiers:** Paint industry wastes, \*Italy.

The treatment of paint polluted waters and container wash waters from paint plants in Italy has been studied. Treatments differ for two types of paints, solvent-based and water-soluble. Because the containers used for solvent-based paints undergo cleaning with other solvents, the resulting waste is rich in solvents. This waste is removed for recovery by distillation and the residual sludges are incinerated. Containers used for water-soluble paints are spray washed with hot water. Waste waters from the washing process are collected in tanks having a three hour retention time capacity. Complete clarification, with the exception of COD and petroleum ether extractable substances, can be obtained with the addition of alum and filtering. When no surface active agents (such as the petroleum ether extractable substances) are present, the wastes may then be treated with simple activated sludge, recycled, and discharged to a sewer. (Kramer-FIRL)

W76-07743

**MICROBIOLOGICAL DEGRADATION OF PHENOL IN THE EFFLUENT FROM A WOOD TREATMENT PLANT,**  
North Texas State Univ., Denton. Dept. of Biological Sciences.

G. R. Vela, and J. G. Rainey.  
The Texas Journal of Science, Vol 27, No. 1, p 197-206, March, 1976. 1 fig, 7 tab, 11 ref.

**Descriptors:** \*Chemical wastes, \*Waste water treatment, \*Phenols, \*Industrial wastes, Organic compounds, Effluents, \*Biodegradation, \*Wood wastes.

**Identifiers:** Wood preserving industry, Creosote, Pentachlorophenol.

Laboratory studies have been conducted on the parameters for bacterial degradation of effluent from wood preserving plant. Preservatives such as creosote and pentachlorophenol contain many phenol derivatives as well as large amounts of heavy oils. Microbial populations that degrade such contaminants vary as a function of time; there is also a variation in the type and concentration of contaminants. The complex kinetics of this system were investigated at the treatment yard of a wood preserving plant in North Texas. Result indicated that a high degree of autopurification in the aerated effluent may be enhanced by proper

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

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conditions. Such conditions include proper temperatures, adequate aeration, and maintenance of large microbial populations. The design for a treatment facility has been derived from these criteria and data are being collected on the system's efficiency. (Kramer-FIRL)  
W76-07744

#### POLYMER PLASTICISERS PRODUCTION EFFLUENT TREATMENT.

German Patent DS 2426-548. Issued November 20, 1975. Derwent German Patents Abstracts, Vol. W, No. 48, p D2, January, 1976.

Descriptors: \*Patents, \*Waste water treatment, \*Polymers, \*Plastics, \*Industrial wastes, \*Water pollution control.  
Identifiers: Plasticizers.

A patent has been granted for a process which treats effluents from the production of polymer plasticizers. Effluent from the esterification of polybasic aliphatic/aromatic acids with aliphatic alcohols in the presence of an H<sub>2</sub>SO<sub>4</sub> catalyst contains alkyl sulfonic acids and dialkyl sulfates. This effluent is purified by heating it to at least 220°C at ambient pressure, followed by separation after previous acidification. The end product may be used as a plasticizer, such as for polyvinyl chloride. The process, therefore, allows the organic products in the effluent to be recovered and recycled and eliminates the need for costly separation and purification stages. (Kramer-FIRL)  
W76-07745

**A TWO-STEP PROCESS FOR TOXIC WASTE-WATERS,**  
Zimpoo Inc., Rothschild, Wis.  
A. R. Wilhelm, and R. B. Ely.  
Chemical Engineering, Vol. 83, No. 4, p 105-109, February 16, 1976. 10 fig.

Descriptors: \*Toxicity, \*Biological treatment, \*Waste water treatment, \*Chemical wastes, \*Oxidation, Industrial wastes, Chemical industry.  
Identifiers: \*Acrylonitrile wastes, Wet-air oxidation.

Chemical wastes, such as those from the manufacture of acrylonitrile, are often biologically refractory or toxic to treatment microorganisms. Because of their large flow volumes and low heat values, incineration is a costly method of treatment. In the United States, such wastes are commonly disposed of by deep-well injection, but new legislative pressure has discouraged this disposal method. Three basic two-step processes have proven successful for treating such wastes. The processes are: wet-air oxidation followed by biological treatment; biophysical treatment, with wet-air oxidation used to regenerate the powdered carbon; and wet-air oxidation with biophysical treatment. Choice of system depends upon such factors as corrosiveness, ease of oxidation, toxicity, and economics. The performance each of these processes is detailed, in terms of BOD and COD reduction and solids concentrations. (Kramer-FIRL)  
W76-07746

**WASTEWATER TREATMENT IN SMALL TEXTILE FINISHING PLANTS A PROCEDURAL SYSTEM. (ABWASSERBEHANDLUNG IN KLEINEREN TEXTILVEREDLUNGSBETRIELEN--EIN VERFAHRENSSYSTEM),**  
J. Fr. Grubler, K. Halle, and F. R. Preuss.  
Wasserwirtschaft-WasserTechnik, Vol. 26, No. 2, p 55-59, February, 1976. 7 fig, 11 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Textiles, \*Flocculation, Color, Chemical oxygen demand, Flotation.  
Identifiers: Ferrous sulfate.

Complex waste water treatment is proposed for small textile plants that cannot utilize the municipal sewer system for waste water discharge. To reduce the costs of production and treatment, it is necessary to reduce the water consumption within technologically feasible limits. Further, waste water treatment may be facilitated by the separation of concentrated waste waters and dilute effluents which later may be recirculated within the process after special treatment. Concentrates should be collected in mixing and equalization tanks for the shortest possible time, usually not longer than one hour, to avoid anaerobic processes. Waste waters are then subjected to mechanical chemical treatment, adopting the continuous flotation method with ferrous sulfate as flocculating agent. The optimal dosage is 1,250 g of hydrated FeSO<sub>4</sub> per cu m of concentrate. The sludge is dewatered in drained drying beds with layer thicknesses of up to 1.80 m. The reductions that can be achieved by the flotation method are 95% alkalinity, 65% detergent concentration, 95% color and BOD<sub>5</sub> content, 70% COD value (as determined by the permanganate method), and 100% sulfide concentration. (Takacs-FIRL)  
W76-07747

#### WATER PURIFICATION PROCESS, Hoechst A. G., Frankfurt am Main (West Germany).

J. W. Lehmann, K. Tannus, and A. Lehman.  
United States Patent 3,947,353. Issued March 30, 1976. Official Gazette of the United States Patent Office, Vol. 94, No. 5, p 2452, March, 1976.

Descriptors: \*Patents, \*Textiles, \*Waste water treatment, \*Industrial wastes, \*Flocculation, Aluminum, Iron, Water purification, Chemical precipitation.

In the treatment of textile waste water, an aluminum or iron salt is often added as an inorganic flocculant to remove suspended and colloidal matter and large molecule anions. A new method was patented for use in treating textile waste waters containing 0.1 g/liter or more of dissolved sodium silicate (Na<sub>2</sub>0.4SiO<sub>2</sub>), which interferes with the conventional flocculation process. This method consists of maintaining a pH between 7 and 8.5 and adding to the waste water about one mol of a monoamine or an acid salt of a monoamine plus about one-half mol of a diamine or its acid salt per mol of sodium silicate. (Kramer-FIRL)  
W76-07748

**WASTE WATER TREATMENT METHOD BY WATER-SOLUBLE POLYMER CONDENSATION BODY (SUIYOSEI KOBUNSHI SHUKUGOTAI NI YORU HAISU SHIROHI),**  
M. Takato, and M. Nishiyama.  
Japanese Patent 51-957. Issued January 12, 1976. 2 p.

Descriptors: \*Waste water treatment, \*Textiles, \*Polymers, Color, Industrial wastes, Organic compounds, Treatment facilities, \*Patents.  
Identifiers: Alum, Nylon dyeing wastes.

A patent has been issued for a method of waste water treatment using a hydrophilic condensation polymer. This polymer is synthesized from tannic acid and formalin in the presence of a naphthalene-tanning dispersing agent. The polymer obtained may be used to coagulate proteins, metal salts, and organic compounds in the waste water from textile and dyeing factories when used together with alum or polyacrylic resins. Waste water was obtained from a dye manufacturing factory, containing 0.5% solid components; it was slightly turbid with a pH between 7.2 and 7.4 and a brown color. When 200 parts waste water were treated with 5 parts 1% condensation polymer solution and 0.1% polyacrylic acid resin solution at normal temperature, the treated liquid was transparent and color was significantly lightened. The pH of the treated

liquid remained the same as before the treatment, while more than half of the solid components were removed. The method was also applied to the treatment of waste water from a nylon dyeing factory. After 200 parts of slightly turbid liquid wastes of a light red-brown color were treated with 1.5 parts 1% condensation polymer and 3 parts 1% alum solution, the resulting treated liquid was colorless. (Katayama-FIRL)  
W76-07749

#### NEW GAS HEATING AND ECONOMIC WASTE WATER PURIFICATION SYSTEM (NEUE GASHEIZUNG UND KOSTENGÜNSTIGES ABWASERREINIGUNGSSYSTEM),

M. Stadelmann.  
Textilveredlung, Vol. 11, No. 1, p 25-28, January, 1976. 1 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Textiles, Economics, Costs, \*Neutralization, Water purification.  
Identifiers: Flue gases, Neutralization.

A new method for the neutralization of alkaline waste waters generated in the dyeing unit of the textile mill Baumann Weberei und Faerbererei AG, Langenthal, Switzerland, is described. The alkaline waste water to be neutralized is sprayed into the flue gases of a natural gas-fired steam generator furnace. The carbon dioxide present in the flue gases neutralizes the waste waters, with sodium carbonate and bicarbonate as reaction products. The neutralized waste water has a pH between 7.2 and 8. No pH control is necessary, and the high residual CO<sub>2</sub> content of the spent flue gas (50-66%) guarantees reliable neutralization even in the case of peak loads. (Takacs-FIRL)  
W76-07750

#### REMOVAL OF CHROMIUM AND ZINC FROM EFFLUENT.

French Patent FR 2265-692. Issued November 28, 1975. Derwent French Patents Abstracts, Vol. X, No. 3, p D5-D6, February, 1976.

Descriptors: \*Waste water treatment, \*Zinc, \*Chromium, \*Metals, Flocculation, Polyelectrolytes, Industrial wastes, \*Patents, Effluents.  
Identifiers: \*Galvanizing plant wastes.

A method has been patented for the removal of zinc and/or chromium from galvanizing plant wastes. The initial solution is made alkaline (pH between 9 and 10) by the addition of a flocculant or polyelectrolyte. Chromium is then partially reduced to the tervalent state by means of a reducing agent such as sodium bisulfite and the zinc and chromium are precipitated. The remaining solution is drawn off with a pump, thus completely removing the zinc and chromium, and avoiding their discharge into natural waters. (Kramer-FIRL)  
W76-07751

#### THE PORI PROCESS: REGENERATION OF HYDROCHLORIC ACID FROM SPENT PICKLE LIQUOR,

Wean United, Inc. Warren, Ohio.  
J. W. Burich.  
Wire Journal, Vol. 9, No. 2, p 57-59, February, 1976. 7 fig.

Descriptors: \*Waste water treatment, \*Pilot plants, \*Treatment facilities, Steel, Recycling, Water reuse.  
Identifiers: \*Hydrochloric acid, Pickle liquors.

A process has been developed by Pori, Incorporated, for the regeneration of hydrochloric acid from spent steel mill pickling solutions. A sequence of several unit operations is involved in the Pori process. Equipment consists of an evaporator, an oxidizer, a hydrolyzer, the falling film condenser absorber system, a tail gas scrubber, a moving bed filter, and necessary

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pumps, storage tanks, and utilities. The technology has been tested at the pilot plant level for two years and the first commercial full scale plant, which is capable of processing 30 gpm of spent HCl pickling liquor, is now under construction. The regeneration plant, being built at J and L Steel Corporation of Cleveland, will process spent pickle liquor from two existing pickle lines; no modifications in the plant operating processes are required. This low temperature process will produce high strength acid and will eliminate the needs to install heat exchangers in pickle lines and to control concentrations of the components in spent pickle liquor. In addition, salable or usable products, such as FeC13 and Fe203 will be produced. (Kramer-FIRL) W76-07752

**CYANIDE COMPOUND RECOVERY BY IMPACT METHOD AND REUSE OF WASTEWATER (SHOGEKIHO NI YORU SHIAN-KAGOBUTSU NO KAISHU TO HAISUI NO SAIKO),**

S. Abe, and Y. Hanami.

PPM, Vol. 7, No. 3, p 33-40, March, 1976. 7 fig, 4 tab, 5 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Water reuse, \*Recycling, Metals, Filters, Operating costs, Treatment facilities.

Identifiers: \*Cyanide compounds wastes.

Treatment of cyanide compounds by the impact method for metal plating waste water is described. The operation is based on the formation of hydrogen cyanide from metal cyanide compounds by adjusting the waste water pH with sulfuric acid. With decreased pH, hydrogen cyanide was formed in the solution, and dissolved HCN could be separated from the solution by an impact apparatus. The solution was sprayed onto a high speed rotating disc; the impact then liberated HCN gas, which was absorbed by the sodium hydroxide solution. In one case, 90% cyanide ion in sodium cyanide solution could be converted to HCN at pH 8, and nearly 100% of the cyanide ion could be converted at a pH below 6. The metal cyanide which did not form HCN remained in the solution and could be separated from the solution by a filtering device. The recovered metal cyanides could then be reused in the plating bath solution; the filtered solution could be reused as the rinsing solution in the plating process. Thus, a closed system of a plating waste water treatment was possible. The operating costs for this treatment method are lower than for the hypochlorous acid method. For the treatment of 47,800 ppm cyanide in the waste water of a zinc plating process, the operating cost of the treatment using the hypochlorous acid method was \$3.88/day; with the impact method, costs were \$0.28/day to treat the same waste water. (Katayama-FIRL) W76-07753

**STUDIES CONCERNING IMPROVEMENT OF WASTE WATER TREATMENT IN THE NICKEL PLANT AUE (UNTERSUCHUNGEN ZUR VERBESSERUNG DER ABWASSERBEHANDLUNG IN DER NICKELHUETTE AUE),**

G. Fersterra, and G. Schmiedel.

Wasserwirtschaft und Wassertechnik, Vol. 26, No. 1, p 7-9, 1976. 1 fig, 1 tab, 19 ref.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Metals, \*Nickel, Pilot plants, \*Copper, Dewatering, Sedimentation, Flocculation, Separation techniques.

Identifiers: Vacuum drum filters.

Laboratory and pilot experiments were conducted to establish the optimal conditions for the separation of nickel and copper compounds from waste waters generated in a nickel smeltery at Aue for subsequent recovery. Gravitational separation in continuous operation was chosen as the most feasible method of treatment. Laboratory tests

revealed the suitability of aluminum sulfate and Stipix N 80 as flocculating agents. However, pilot plant experiments revealed no substantial difference in efficiency with or without the use of flocculating agents. Therefore, a continuous gravitational sedimentation method without flocculating agents was chosen. The optimal conditions were a pH value of 9.5, and a sedimentation rate of 0.13 m/hour. The sludge containing copper and nickel will be dewatered in a vacuum drum filter for metal recovery. (Takacs-FIRL) W76-07755

**IRON-CONTAINING ACID WASTE WATERS TREATMENT.**

French Patent FR 2261-984. Issued October 24, 1975. Derwent French Patents Abstracts, Vol. W, No. 50, p D4, January, 1976.

Descriptors: \*Waste water treatment, \*Patents, \*Iron, \*Metals, \*Industrial wastes, \*Steel, Recycling, Water reuse, Neutralization, Oxidation.

Identifiers: Magnetite.

A process has been patented for the treatment of waste water from the production of steel. Iron-containing waste waters which also contain HCl, HF, and/or H<sub>2</sub>SO<sub>4</sub> are treated at ambient temperatures (at least 21°C) with a neutralizing agent such as NaOH or Ca(OH)<sub>2</sub>. This will maintain a waste water pH at which iron is precipitated almost completely. The mixture is then stirred and aerated to oxidize 60 to 70 weight percent of the precipitate and to convert the ferrous precipitate into hydrated magnetite. The magnetite can be dried and processed for recycling as a sintered charge or as magnetite Fe powder. (Kramer-FIRL) W76-07756

**USING WASTES FOR WASTE CLEANUP.**

Chemical Week, Vol. 118, No. 13, p 32, March 31, 1976.

Descriptors: \*Oil wastes, \*Waste water treatment, \*Recycling, Sludge, Industrial wastes, New Jersey.

Identifiers: Spent oil refinery catalysts, Sodium aluminate.

The process for regenerating spent oil refinery catalysts at Matthey Bishop, Incorporated, in Winslow, New Jersey, yields as a by-product sodium aluminate solution. In the leaching of precious metals from catalysts, 50% sodium hydroxide solution is added and the mixture is reacted in an autoclave. After double filtration, the precipitated sludge contains the precious metals with sodium aluminate as the filtrate. This by-product will be sold to industrial plants to supplement alum in their waste water treatment processes. Pilot scale tests have shown sodium aluminate to be an efficient coagulant aid in the clarification of waste water, matching the suspended solids and phosphate removal of alum. Sodium aluminate also prevented the pH depression caused by acid salts of aluminum, lowered the total dissolved solids of the effluent, increased the floc formation rate of treated wastes, and reduced the effluent BOD. While two years ago the company was unaware of the possibility of the waste treatment market as an outlet for its catalyst recycle waste, current plans are to market one million gallons of sodium aluminate per year. (Kramer-FIRL) W76-07757

**STUDY ON THE REMOVAL OF AROMATIC HYDROCARBONS FROM INDUSTRIAL WASTEWATERS BY MEANS OF ACTIVATED CARBON (STUDIO PER LA RIMOZIONE DI IDROCARBURI AROMATICI DA ACQUA DI SCARICO INDUSTRIALI TRAMITE CARBONI ATTIVI),**

G. Gorretti, M. Massi, B. M. Petronio, A. Bertoldi, and A. J. Panagiotou.

Inquinamento, Vol. 17, No. 12, p 20-24, December, 1975. 6 fig, 2 tab.

Descriptors: \*Organic compounds, \*Waste water treatment, \*Activated carbon, \*Industrial wastes, \*Chemical wastes.

Identifiers: Hydrocarbons.

The first step in removing aromatic hydrocarbons from industrial waste waters with activated carbon is the grinding of the carbon into a fine powder. Following drying, the powder is mixed into a water solution containing only the hydrocarbons. The absorption isotherms are obtained by maintaining constant the volume of the sample and the quantity of hydrocarbons and by varying the quantity of carbon from 0.1 to 5.0 g/liter. After agitating the samples to evenly distribute the hydrocarbons, the samples are filtered under pressure and the first fraction is discarded while the remainder of the sample is used for the determination of hydrocarbon residue; this is achieved with a method based on chromatography on a thin "canalized" film. Both carbons used (Pittsburg and Westvaco) can reduce hydrocarbon content to less than one mg/liter after 2 hours. A pilot plant, using Pittsburgh carbon in 12 X 40 granular form, reduced the total hydrogen content per gram of carbon to a value  $x/Q$  ( $x$ : quantity of hydrocarbons,  $Q$ : weight of the carbon) of 0.169 grams. After 153 hours of functioning, the anaerobic decomposition of the hydrocarbons was noted in all three columns; this was totally eliminated by passing through the columns 100 ml 5% HCl for three minutes. The passage of vapor through the columns for 16 hours leads to a 10% recovery of the hydrocarbons, with a regeneration efficiency of 75%. (Waltner-FIRL) W76-07758

**REFINERY WASTEWATER TREATMENT AND REUSE,**

Frantz Co., Houston, Tex.

K. E. Bush.

Chemical Engineering, Vol. 83, No. 8, p 113-118, April 12, 1976. 2 fig, 24 ref.

Descriptors: \*Oil wastes, \*Waste water treatment, \*Industrial wastes, Design criteria, Activated sludge, Trickling filters, Tertiary treatment, Lagoons, Activated carbon, Adsorption, Oxidation, Reviews, \*Water reuse, Organic compounds.

Identifiers: Refinery wastes.

The process engineer must keep familiar with changing regulations and technology. A review of current design processes for petroleum refinery waste water treatment is presented. Unit processes are categorized as primary, intermediate, or secondary/tertiary. The choice of one or more of these stages depends upon the quality of the raw effluent and the required pollutant reduction. The procedures detailed include sulfide/ammonia stripping, oil removal, pH control, dissolved air flotation, activated sludge, trickling filters, waste stabilization ponds, aerated lagoons, filtration, carbon adsorption, and chemical oxidation. (Kramer-FIRL) W76-07759

**WATER REUSE AND RECYCLE IN THE CDEHDED BLEACH SEQUENCE,**

CIP Research Ltd., Hawkesbury (Ontario).

J. A. Histed, and F. M. A. Nicolle.

Tappi, Vol. 59, No. 3, p 75-77, March, 1976. 3 fig, 6 tab, 5 ref.

Descriptors: \*Pulp and paper industry, \*Waste water treatment, \*Water reuse, \*Recycling, Industrial wastes.

Identifiers: Kraft mill bleachers.

Water reuse and recycling in the kraft mill bleachers has been investigated. In kraft mill bleachers, the normally low temperature associated with the hypochlorite stage of the CDEHDED bleach sequence has created an obsta-

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

cle to direct countercurrent washing. Laboratory simulation demonstrated that the hypochlorite stage can be operated at 80°C in a tight countercurrent washing system with no adverse effects on the properties of fully bleached pulp. Extensive chlorination filtrate recycling is practiced, thus reducing the volume of effluent from the chlorination sewer to 491 U.S. gal/airdry ton of bleached pulp (adbt). Total effluent from the EHDED stages could be reduced to 976 U.S. gal/adbt using the tight countercurrent washing system. (Kramer-FIRL)  
W76-07760

#### COKING OF WASTE KRAFT PULPING LIQUORS AT LOWERED PH,

Texaco, Inc., New York. (Assignee).  
H. V. Hess, E. L. Cole, and W. F. Franz.  
United States Patent 3,944,462. Issued March 16, 1976. Official Gazette of the United States Patent Office, Vol. 944, No. 3, p 1356, March, 1976. 1 fig.

Descriptors: \*Pulp and paper industry, \*Waste water treatment, \*Patents, \*Industrial wastes, Incineration, Adsorption, Burning, Hydrogen ion concentration.  
Identifiers: \*Coking, Kraft pulping liquors.

A patent has been issued for a process to treat alkaline kraft pulp liquors at a lowered pH. In an absorbing zone, extraneous SO<sub>2</sub> is added to the kraft liquors, lowering the pH by at least one unit. The liquors are then coked in the liquid phase without air by heating them to a temperature between 450 and 700°F, at a pressure from 1000 to 3000 psig for 0.5 minutes to 6 hours, thereby forming coke. The gases formed, which include H<sub>2</sub>S and an aqueous effluent, are treated so that the coke is separated from the effluent. The coke is burned to produce sulfur dioxide. Lime and H<sub>2</sub>S are added to the effluent in a second absorbing zone to form new kraft cooking liquor. (Kramer-FIRL).  
W76-07761

#### PROCESS CONTROL METHOD FOR THE CHEMICAL PURIFICATION OF WASTEWATERS (SPOSOB OPERATIVNOGO UPRAVLENIYA PROTSESSOM KHIMICHESKOY OCHISKKI STOCHNYKH VOD),

I. G. Alesina, M. M. Krunchak, V. P. Semenov, V. Ponizovskiy, and A. F. Milagin.  
Bumazhnaya Promyslennost, No. 1, p 22-23, 1976. 1 fig, 1 tab, 2 ref.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Color, Mathematical studies, Biological treatment, Alkalinity, Coagulation.  
Identifiers: Sulfate pulpmaking.

Functional relationships were established between the basic initial parameters of waste waters generated in sulfate pulp making, in order to develop process controls for the purification of such waste water following biological treatment. These included color and alkalinity, the dose of the coagulant (alum), and the quantity of the coagulant that can be replaced by sulfuric acid to reduce the alkalinity. Part of the coagulant is used up to acidify the waste water and create optimal conditions for coagulation, and a minimal coagulant dose was determined as a function of the color of the waste water. It was therefore possible to replace an additional quantity of coagulant by acid. The mathematical relationships obtained make it possible to adopt process control for coagulant dosage as a function of the initial color and alkalinity of the biologically treated waste water. (Takacs-FIRL).  
W76-07762

#### HIGH GRADIENT MAGNETIC FILTRATION OF MAGNETIC AND NON-MAGNETIC CONTAMINANTS FROM WATER,

Harvard School of Public Health, Boston, Mass.

Dept. of Environment Health Sciences.

R. Mitchell, G. Bitton, and J. A. Obercuffer.  
Separation and Purification Methods, Vol. 4, No. 2, p 267-303, 1975. 14 fig, 7 tab, 37 ref.

Descriptors: \*Filtration, \*Separation techniques, \*Waste water treatment, \*Industrial waste, \*Municipal wastes, Water pollution control.

Identifiers: \*Magnetic filtration.

High gradient magnetic separators have been developed which are capable of efficient separation of even weakly magnetic suspended solids or precipitates for which conventional magnetic separation techniques are ineffective. Non-magnetic colloidal material in polluted water may also be removed by high gradient magnetic devices following the addition or 'seeding' of small quantities of magnetic iron oxide (magnetite). Pollutants are rapidly filtered from water, with a minimum of energy expenditure. Because magnetic forces on fine particles may be several times greater than gravitational forces, removal is more efficient than with sedimentation. An overview is presented on the removal of individual pollutants by direct and seeded high gradient magnetic filtration. These treatments are applicable to both polluted natural waters and to industrial waste waters. (Kramer-FIRL).  
W76-07763

#### PRELIMINARY STUDY OF EXPERIMENTAL SYSTEM FOR AMMONIA REMOVAL AT SOUTH LAKE TAHOE ADVANCED WASTE-WATER TREATMENT PLANT,

R. Cuena.

In: Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sands Vagabond Convention Center, South Lake Tahoe, California, Report No. NSF/RA/G-74-012, p 3-21.

Descriptors: \*Waste water(Pollution), \*Waste water treatment, \*Ammonia, \*Domestic wastes, Tertiary treatment, Treatment facilities, Sprays, Pollutants, Water pollution, Nitrates, Lime, Ponds.

Identifiers: \*Ammonia removal, \*Lake Tahoe(Nev - Calif).

Nitrogen first enters the treatment plant in domestic wastewater in the form of ammonia and organic nitrogen compounds. Total nitrogen in domestic wastewater can vary from 20 to 55 mg/l. In the activated sludge treatment process such as that at South Lake Tahoe, these compounds are first hydrolyzed and then oxidized by microorganisms until all of the nitrogen is converted to aqueous ammonia. As the result of research conducted in South Africa and Israel, interest was stimulated in a method of ammonia removal which had never been tried at plant scale. The system is basically comprised of four components. Following chemical clarification of the lime treated wastewater, the water is transferred to a high pH detention pond. The detention time in the pond varies from 5 to 12 hrs depending on the influent flow rate. This first pond is followed by a second detention pond in series. This pond has installed a system of 46 spray nozzles. Following the ponds is a modified stripping tower. Installed in the interior of the tower is a system of 24 spray nozzles identical to those in the spray pond. The final step was breakpoint chlorination which had previously been used at South Lake Tahoe. (See also W76-07793) (Sims - ISWS)  
W76-07794

#### ORE MINING AND DRESSING POINT SOURCES CATEGORY, INTERIM FINAL RULES.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07844

#### ORE MINING AND DRESSING POINT SOURCE CATEGORY.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07845

#### COAL MINING POINT SOURCE CATEGORY: APPLICATION OF EFFLUENT LIMITATIONS GUIDELINES FOR EXISTING SOURCES TO PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07847

#### COAL MINING POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07848

#### MINERAL MINING AND PROCESSING POINT SOURCE CATEGORY INTERIM FINAL RULEMAKING.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07849

#### GRAIN MILLS POINT SOURCE CATEGORY: PROPOSED PRETREATMENT STANDARDS FOR NEW SOURCES.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07850

#### INK FORMULATING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS,

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07851

#### NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07852

#### NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY,

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07854

#### CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING,

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07855

#### IRON AND STEEL MANUFACTURING POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07856

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Waste Treatment Processes—Group 5D

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07957

**A NEW TIGHT FIT - INSERTION OF A PLASTIC LINER IN A 42 INCH SEWER.**  
For primary bibliographic entry see Field 8G.  
W76-07994

**LAYING 5,000 FT. OF METAL PIPE IN 24 DAYS.**  
For primary bibliographic entry see Field 8A.  
W76-07995

**POLLUTION OF THE RUNOFF IN SEPARATE SEWER SYSTEMS, AND MEASURES FOR THE REDUCTION OF RAINWATER RUNOFF-GENERATED POLLUTION OF WATER BODIES (DIE VERSCHMUTZUNG DES ABFLUSSES IM TRENNVERFAHREN SOWIE MASSNAHMEN ZUR VERMINDERUNG DER GEWAESSERVERSCHMUTZUNG INFOLGE REGENWASSEREINLEITUNGEN),**  
For primary bibliographic entry see Field 5B.  
W76-07997

**LARGEST PVC FILTER INSTALLATION.**  
For primary bibliographic entry see Field 8G.  
W76-07998

**VIRUS REMOVAL AND INACTIVATION BY PHYSICAL-CHEMICAL WASTE TREATMENT,**  
Baylor Coll. of Medicine, Houston, Tex. Dept. of Virology and Epidemiology.  
M. D. Sobsey, C. Wallis, M. F. Hobbs, A. C. Green, and J. L. Melnick.  
Journal of the Environmental Engineering Division, Proceedings of ASCE, Vol. 99, No. EE3, p 245-252, June, 1973. 1 fig, 3 tab, 19 ref.

Descriptors: \*Waste water treatment, Viruses, Chlorination, Activated carbon, Adsorption, Flocculation, Filtration, Diatomaceous earth, \*Sewage treatment.  
Identifiers: \*Virus removal, Communition, Vacuum filtration, \*Physico-chemical treatment, Package plants.

A prototype of a packaged sanitary waste water treatment system employing physical-chemical processes has been evaluated for its ability to remove and inactivate enteric viruses. The treatment system, consisting of comminution, chlorination, activated carbon adsorption, alum flocculation, and vacuum filtration using diatomaceous earth as a filter aid, was designed for a variety of situations where conventional biological treatment is impractical. Both simulated marine sewage and simulated river water to which vaccine strain type I poliovirus was added as a marker were used as influent waste water. The treatment system was capable of reducing the total amount of virus in the waste water from about 99.96% reduction when marine sewage was processed, and from over 99.9996% reduction when simulated river water was processed. However, about 2.6% and 0.16% of the total influent virus was detectable in filter cake solids from raw sewage and from simulated river water, respectively. The degree of virus reduction in the treatment system is superior to that obtained in conventional primary and secondary waste water treatment. (Sandoski-FIRL)  
W76-07999

**SEWAGE PURIFICATION SYSTEM LICENSE.**  
Die Sieviele Ingenieur in Suid-Afrika, Vol. 15, No. 1, p 28, January, 1973. 1 fig.

Descriptors: \*Sewage treatment, Activated sludge, Effluents, Nitrogen, Reclamation, Costs, Construction, Operation and maintenance, \*Waste water treatment, Effluents, Africa.  
Identifiers: South Africa, Orbital Sewage Purification System.

The South African Inventions Development Corporation has granted an exclusive license to the Orbital Purification (Pty) for the exploitation of the Orbital Sewage Purification System in Southern Africa. The system is based on the principles of the activated sludge process and produces a well-stabilized sludge as well as a high-purity effluent. Owing to the exceptionally low nitrogen content, the effluent is suitable for reclamation. The cost of sewage treatment using the Orbital System is lower than that of conventional systems, due partly to inexpensive construction and maintenance and simplicity of operation. (Sandoski-FIRL)  
W76-08000

**4000-FOOT OUTFALL HAS 640-FOOT DIFFUSER FOR OCEAN DISPERSAL.**  
For primary bibliographic entry see Field 5E.  
W76-08002

**THE APPLICATION OF PURE OXYGEN FOR WASTE WATER PURIFICATION WITH ACTIVATED SLUDGE (DIE ANWENDUNG VON REINEM SAUERSTOFF BEI DER ABWASSERREINIGUNG MIT BELEBTEM SCHLAMM),**  
K. Scherz.  
Muenschner Beiträge zur Abwasser-, Fischerei- und Flussbiologie, Vol. 22, p 109-124, 1973. 7 fig, 2 tab, 24 ref.

Descriptors: \*Waste water treatment, \*Oxygen, Aerobic bacteria, Activated sludge, Carbon dioxide, Biochemical oxygen demand, Chemical oxygen demand, Sludge, Aerobic treatment, \*Oxygenation.  
Identifiers: \*UNOX, Sludge concentration, High purity oxygen.

A new treatment method using oxygen instead of air for the supply of aerobic bacteria in the activated sludge process is entitled UNOX. The UNOX oxygen entry system, requires a series of inter-connected gas-tight chambers closed on top and an even distribution of activated sludge over the chambers to achieve a 90 percent use of the oxygen. Oxygen is supplied to the first low pressure chamber, drawn on by means of compressors installed on top of the chambers, and transported into the sludge through a hollow agitator axle. Eight perforated arms are installed through which the oxygen may leave. This process is repeated in successive chambers. Each chamber has its own gas circulation maintained by the compressors. Since oxygen is constantly consumed by the water-sludge mixture and carbon dioxide is produced during the decomposition processes, the oxygen concentration drops from chamber to chamber until only 40 to 50 percent remains, with spent gas escaping to the atmosphere. Experimental plants operating with the UNOX method have been constructed in New York, Ohio, and Louisiana. In the Cincinnati plant, a BOD reduction of 91.4 and 96.1 percent was measured for residence times of 2.2 and 2.8 hours; COD dropped by 77 and 84 percent; and, sludge concentration increased to 8.8 g/liter with an oxygen concentration exceeding 6 mg/liter. (Nave-FIRL)  
W76-08004

**THE MAINTENANCE AND MANAGEMENT OF SEWAGE PIPE SYSTEMS (GESUKANRO NO IJI KANRI),**  
Osaka Municipal Government Bureau of Sewage Works (Japan).  
For primary bibliographic entry see Field 8A.  
W76-08005

**BIOLOGICAL SEWAGE TREATMENT INSTALLATIONS (BIOLOGISCHE ABWASSERREINIGUNGSANLAGEN).**  
Wasserwirtschaft-Wassertechnik, Vol. 23, No. 3, p 105, 1973.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Sewage treatment, \*Biological treatment, Automatic control, Aeration, Organic matter, Sludge.  
Identifiers: Package treatment.

A compact sewage treatment installation, designed for complete biological treatment of sewage in small communities, vacation establishments, hotels, or small industrial sites, has been produced in Czechoslovakia in four sizes, with 25, 40, 65, and 93 cubic meters nominal tank volume. The easily mounted and transported system has a rectangular steel container for the frame installed on a concrete plate and is comprised of three parts: a dry intake space with a slotted drum rack, an activation space aerated through a shaft, and a settling space with a resettable overflow chute. Protected by an overhead roofed service platform, the system includes automatic control, a heater, an auxiliary transformer for portable lighting, and a 220 v transformer for electric drive equipment. In the activation space, the sewage is circulated under intensive aeration, and organic matter gradually mineralized. The sludge must be discharged periodically. (Holz-FIRL)  
W76-08006

**EFFICIENCY OF HEAVY METALS REMOVAL IN MUNICIPAL SEWAGE TREATMENT PLANTS,**  
Environmental Protection Agency, Kansas City, Mo.  
H. G. Brown, C. P. Hensley, G. L. McKinney, and J. L. Robinson.  
Environmental Letters, Vol. 5, No. 2, p 103-114, 1973. 2 fig, 3 tab, 9 ref.

Descriptors: \*Municipal wastes, \*Treatment facilities, \*Waste water treatment, Heavy metals, Monitoring, Sampling, Chromium, Copper, Lead, Aeration, Sludge, \*Sewage treatment.  
Identifiers: \*Heavy metals removal, Suspended solids removal.

During the period from January to July 1972, six municipal sewage treatment plants were monitored for the efficiency of heavy metals removal. Composite samples from several locations within each plant were analyzed for cadmium, chromium, copper, zinc, and lead. The efficiencies for the removal of each metal from each plant were studied. The results of this study show that chromium, copper, and lead were more efficiently removed in secondary treatment processes than in primary processes. Chromium is reduced during aeration in the secondary process, copper is strongly adsorbed by the microbial floc, and lead is removed more efficiently because of increased settling time and larger particle size in secondary treatment. Zinc was removed equally well from all plant types. Removal correlations for cadmium could not be made. The results from the six plants in this study indicate that a definite advantage of a secondary treatment plant over a primary treatment plant in heavy metals removal is the increased suspended solids (SS) removal. This increased SS removal results in an exponentially increased heavy metals removal. (Sandoski-FIRL)  
W76-08008

**POLLUTION OF WATER BODIES BY ARTIFICIAL RUNOFF OF RAINWATER POLLUTION BY WASTE WATER OF MIXED SEWERS (BELASTUNG DER GEWAESSER DURCH KUENSTLICHE ABLEITUNG VON NIEDERSCHLAEGEN, BELASTUNG DURCH ABWAESSER DER MISCHKANALISATION).**  
For primary bibliographic entry see Field 5B.  
W76-08009

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5D—Waste Treatment Processes

PREFAB CASTING SYSTEM PACES SEWER JOB THROUGH WET SITE,  
McGraw-Hill World News, Vienna (Austria).  
For primary bibliographic entry see Field 8A.  
W76-08012

ROTATING SCREEN SEPARATOR,  
Sweco, Inc., Los Angeles, Calif. (Assignee).  
P. H. Mook.

United States Patent 3,743,094. Issued July 3, 1973. Official Gazette of the United States Patent Office, Vol. 912, No. 1, p 151-152, July 3, 1973.

Descriptors: \*Screens, \*Combined sewers, Sewerage, Flow rates, Effluents, \*Patents, Overflow, \*Waste water treatment, Sewage treatment, Cleaning, \*Separation techniques.  
Identifiers: \*Rotating screen separators.

Equipment and methods for screening and concentrating waste water overflow from combined sewer systems are disclosed. Exemplary equipment includes a separator employing a substantially cylindrical rotating screen. Influent is piped upwardly into the equipment and deflected outwardly toward the inner surface of the screen in a manner to achieve a desired flow rate and flow pattern of the influent onto the screen. Means are provided for controlling the flow rate and for suitably directing the influent in a plurality of substantially discrete inclined streams toward the inner surface of the rotating screen. The screen is rotated at a speed to achieve a desired centrifugal force. Effluent passes through the screen to an outlet and the remaining concentrate passes to an outlet. A certain amount of the influent splashes from the inner surface of the screen, and is received by a backslash pan and may be recirculated and rescreened. The screen is in the form of a screen cage having a plurality of removable screen panels for facilitating replacement of damaged screens or changing of screen type or mesh size. Cleaning means is provided for directing a cleaning fluid periodically at the screen. (Sandoski-FIRL)  
W76-08018

DEVICE FOR SEPARATING SOLIDS AND OTHER FOREIGN BODIES FROM LIQUIDS IN A PIPE CONDUIT,  
Siemens A. G., Munich (West Germany).

K. Ruthrof.  
United States Patent 3,747,771. Issued July 24, 1973. Official Gazette of the United States Patent Office, Vol. 912, No. 4, p 1409, July 24, 1973.

Descriptors: \*Conduits, \*Screens, Flow, \*Patents, \*Separation techniques, Equipment, \*Waste water treatment.  
Identifiers: Separated solids.

A patented device for separating solids and other foreign bodies from liquids in a pipe conduit includes a screen mounted in the conduit which is conically tapered in the flow direction. A discharge tube for the separated solids, leading to the outside, is connected at the apex of the screen. A barrier is arranged on the outer side of the screen which extends perpendicularly to the surface of the screen between the individual rows of holes of the screen. (Sandoski-FIRL)  
W76-08017

ULTRASONICS IN THE SEWAGE INDUSTRY,  
Municipality of Metropolitan Seattle, Wash.  
J. Wolff.  
Water and Sewage Works, Vol. 120, No. 5, p 84-85, June, 1973. 2 fig.

Descriptors: \*Waste water treatment, \*Instrumentation, \*Ultrasonics, Monitoring, Treatment facilities, Interceptor sewers, Pollutant identification, Cities, Washington.  
Identifiers: Seattle(Wash), Sensors.

The Municipality of Metropolitan Seattle (Metro) which has the responsibility for wholesale collection and treatment of storm water and sanitary sewage in the Seattle metropolitan drainage basin, is pioneering the use of ultrasonics for level measurement and control in the sewage industry. Ultrasonic level measuring systems, designed and manufactured by Western Marine Electronics (Wesmar) of Seattle, have been installed in two of Metro's six treatment plants, at the north trunk interceptor and in a pumping station. The level monitor is a non-contacting continuous measuring system. Each system is comprised of two basic components, a sensor and a solid-state electronics unit interconnected by coaxial cable, capable of operating at distances up to 500 feet apart. The sensor, mounted above the material to be measured, is a combination sonic transmitter-receiver. It emits an ultrasonic signal onto the target and the echo is reflected and detected by the same sensor. The signal is then transmitted through the coaxial cable to the electronics unit, where the time interval between transmission and reception is computed. This time computation is converted to a continuous electrical output which is in turn displayed on a meter in engineering units or fed to process control equipment or recorders. (Sandoski-FIRL)  
W76-08018

OXYGEN MEASUREMENT IN ACTIVATION BASINS WITH THE ZUELLIG-02-PROBE,  
For primary bibliographic entry see Field 5A.

W76-08019

SEDIMENTATION TECHNOLOGY IN DEVELOPMENT (SEDIMENTATION-TEKNIK UNDER UTVECKLING),  
J. Hjort.  
Kemisk Tidskrift, Vol. 85, No. 5, p 46-48, May, 1973. 2 fig.

Descriptors: \*Sedimentation, \*Sludge treatment, Flocculation, Settling basins, Valves, Pumping, Drainage, \*Waste water treatment.  
Identifiers: Sedimentation technology, Sweden.

The Lovoe-type flocculation and sedimentation basin in Sweden has been improved by incorporating the following changes. Sludge drainage through bottom valves, which requires a long time and provides sludge with a low dry content, has been replaced by perforated tubes mounted on wheels which are moved back and forth, over and underneath the intermediate bottom in a flow direction for sludge suction. Sludges with a dry content of two to three percent can be tapped gravitationally, while sludge with higher dry content need pumping. Sludge tapping, its frequency and duration are chosen as a function of the dry matter content in the sludge. The bacteria count in decantates from sedimentation basins with this sludge drainage system did not differ from that in decantates from conventional basins. No chlorination is applied in the flocculation and settling stages. (Takacs-FIRL)  
W76-08020

BOCA RATON'S NEW WASTEWATER TREATMENT PLANT,  
V. W. Longworthy.  
Water and Sewage Works, Vol. 120, No. 5, p 65, June, 1973. 3 fig.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Activated sludge, Aeration, Chlorination, Sludge, Sludge disposal, Landfills, Atlantic Ocean, Florida.

Identifiers: Boca Raton(Fla), Aerobic digestion, Vacuum filtration.

Black, Crow and Eidsness has designed an activated sludge process at Boca Raton, Florida's new 10 mgd waste water treatment plant which can be operated as a contact stabilization or a

completely mixed system. The sequence is aeration-final settling-chlorination, with aerobic digestion of sewage solids. The resulting sludge is decanted, then concentrated to ten percent solids in a basket-type centrifuge. Thickened sludge is trucked to a sanitary landfill. Sludge from the city's adjacent water softening plant is vacuum filtered at the waste water treatment plant. The cake, containing 65 percent solids is trucked off the site and used as a road building base. Treated effluent is chlorinated at the plant and rechlorinated three miles away at the Atlantic Ocean beach before discharge (one mile from shore in 90 feet of water through a 36-inch diameter cast iron outfall). (Sandoski-FIRL)  
W76-08021

A SURVEY OF CHIBA MUNICIPAL CENTRAL SEWAGE TREATMENT PLANT (CHIBA-SHI CHUO GESUI SHORIJO NO GAIYO), Chiba Municipal Government, (Japan). Bureau of Construction.

T. Suzuki, and T. Kamiharu.  
Gesuido Kyokai-shi, (Journal of Japan Sewage Works Association), Vol. 10, No. 109, p 53-62, June, 1973. 3 fig. 2 tab.

Descriptors: \*Treatment facilities, \*Waste water treatment, Waste water disposal, Sewage effluents, Activated sludge, \*Sludge treatment, Digestion tanks, Aeration, Suspended solids, Chlorine, Oceans, Dehydration, Incineration.  
Identifiers: Chiba Municipal Sewage Treatment Plant, Settling tanks, Japan.

The Chiba Municipal Sewage Treatment Plants comprise three major districts serving a combined population of 1,275,000. The Central Treatment Plant construction was started in 1965 and the entire plan is being completed in three stages. Presently in the final stage, the installation of a sludge treatment system is under construction. The treatment capacity is planned for 110,760 cu m/day, but presently treats only 71,140 cubic meters in dry weather and 83,400 during rainfall. The effluent has a BOD of 200 mg/liter and suspended solids of 300 mg/liter with removal percentages of 92.5 and 89.0, respectively. The sewage effluent enters the receiving pond, where the pressure distributes the water into three settling ponds. The settled sludge is sent to the sludge relaying system and goes to the sludge concentration tank and to the digestion tank; the exhaust gas is sent to the gas tank and is used as a boiler fuel. The sludge is finally washed, dehydrated, and incinerated. The supernatant water from the first settling tanks goes to the aeration tank where the high pressure air from the blower helps oxidize organic matter and water quality is stabilized. The final settling tank settles the activated sludge mixed in the aeration tank and returns the sludge to the aeration tank. Chlorine is added for disinfection. Treatment water is cycled to the water tank or discharged to the ocean. (Seigle-FIRL)  
W76-08022

PROCESS 100% EFFECTIVE.  
Water and Wastes Engineering, Vol. 10, No. 7, p 22, July, 1973.

Descriptors: \*Waste water treatment, \*Ozone, \*Laboratory tests, Catalysts, Taste, Odor, Tertiary treatment, Irradiation, Ultrasonics.  
Identifiers: \*Sonocatalysis, Ultrasonic irradiation.

A two-hour laboratory test has shown that a simple process involving a metal catalyst, ozone injection, and ultrasonics, can remove 42% of organic carbon materials left in waste water after it has already gone through the primary and secondary treatment stages. These results came from using a standard catalyst called Raney-Nickel, in combination with ozone and ultrasonic irradiation from a high frequency generator, which produces better oxidation reactions. The method, called sonocatalysis, can be used as a third stage polish-

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Ultimate Disposal Of Wastes—Group 5E

ing operation to clean up waste water at a theoretical level of total purity. This process does a much better job than traditional third stage methods without the necessity of adding chlorine which can react with remaining trace impurities to produce unpleasant tastes and odors. (Sandoski-FIRL)  
W76-08023

**WASTEWATER TREATMENT SYSTEM USES CALCINER.**  
Rock Products, Vol. 76, No. 7, p 62, 85-86, July, 1973. 3 fig.

Descriptors: \*Waste water treatment, \*Municipal wastes, \*Heat treatment, \*Lime, Filters, Activated carbon, Chlorination, \*Recycling, Neutralization, \*Water reuse, Suspended solids, Adsorption.  
Identifiers: Z-M Process, Physico-chemical treatment, Multiple-hearth furnace.

The multiple-hearth furnace plays a key role in a municipal waste water treatment system developed by the Envirotech Corporation. Lime is regenerated in the furnace from the hydroxides and carbonates formed in lime and soda ash treatment of raw waste water. The recalcined lime is returned to the influent, and carbon dioxide evolved in the furnace is used in a neutralization step. Designated the Z-M Process, the new method utilizes chemical and physical techniques to provide reusable water without biological treatment. There are three distinct operating zones. The upper hearths form the drying and preheat zone where most free moisture is evaporated. The middle combustion zone is where the material is processed. The lower section of the furnace is the cooling zone where material is cooled prior to discharge. Overflow from the second-stage reactor-clarifier then passes through granular media filters to capture suspended solids which remain after lime treatment and recarbonation. The neutralized waste water then flows through a carbon adsorber. Small molecules are adsorbed on the surface of the granular activated carbon. After chlorination, the resulting product water may be used for recycle or discharged in compliance with local standards. The activated carbon is regenerated for recycle in a multiple-hearth furnace. (Sandoski-FIRL)  
W76-08024

**SEWER ALARM SYSTEM SAVES TAXPAYERS' DOLLARS,**  
Milford Dept. of Public Works, Conn.  
A. Benedoso.  
Public Works, Vol. 104, No. 9, p 113-114, September, 1973. 3 fig.

Descriptors: \*Sewerage, \*Treatment facilities, Costs, Sewers, Pumping, Monitoring, Connecticut.  
Identifiers: Milford(Conn), Alarm systems, Lift stations.

Milford, Connecticut, has approximately 80 miles of sewer lines which require 13 lift stations to pump sewage over various crests so that gravity flow can then carry it to one of the four treatment plants in the city. Concern over malfunctions or failures at the lift stations encouraged the townspeople to purchase and install an alarm system which provides for fire, flooding, and sludge-caused high water warnings for each plant. The alarm system was purchased piecemeal and installed by local electricians, with minor modifications to meet the needs of the sewage treatment facilities. The entire project, including labor, materials, and consulting fees cost \$15,000. Among the advantages of the system are reduced costs by use of public utility lines, major purchase of standard equipment which provides savings over leasing, and the ability of local electricians to repair and maintain the equipment. Also, constant visual surveillance of the entire sewer system is maintained with the ability to expand the status

board and alarm system when the sewer system is extended. (Sandoski-FIRL)  
W76-08030

**'SATELLITE PLANTS' - SPECIAL TREATMENT FACILITIES.**  
Water and Wastes Engineering, Vol. 10, No. 8, p 9, August, 1973.

Descriptors: \*Treatment facilities, \*Combined sewers, \*Separated sewers, \*Waste water treatment, Storm runoff, Capital costs, Operating costs, Sewers, Storm drains, Overflow, Wisconsin.  
Identifiers: Racine(Wis).

Special treatment facilities being tested in Racine, Wisconsin, and which are located at points where discharge into a river or stream occurs, may be an alternative to the costly and inconvenient process of separating combined storm and sanitary sewers. At a cost of \$2 million, the new facility has relatively lower capital costs and higher operating costs than Racine's main dry weather waste water treatment plant, since 'satellite plants' operate only about one percent of the time, when overflow conditions take place. The system has a total capacity of 60 mgd and serves over 450 acres of combined sewers. The site chosen for the demonstration project receives discharge from the two largest relief points in the city's interceptor system. Estimates for the cost of separating combined storm and sanitary sewers would run between \$10 and \$13 million and the separation still would not treat the surface pollution. (Sandoski-FIRL)  
W76-08031

**SEWAGE PLANT USES NATURAL FEATURES TO CUT COSTS.**

Engineering News-Record, Vol. 191, No. 10, p 14, August 30, 1973. 1 fig.

Descriptors: \*Municipal wastes, \*Treatment facilities, \*Waste water treatment, Tertiary treatment, Soil properties, Topography, \*Sewage treatment, Soil types, Adsorption, Septic tanks, Lagoons, Aeration, Oxidation, Waste water disposal, Costs.

The result of a \$6000 study on municipal waste control was a concept that uses the existing topography and the soil characteristics of the area to provide advanced treatment at a fraction of the cost of standard primary-secondary-tertiary sewage treatment methods. In cleanup terms, this means a 99 percent purification of the St. Donat, Quebec, sewage. Key to the successful implementation of this treatment method is the type and absorption of the soil, which is predominantly sand and gravel. Once the plant is completed, primary treatment will be provided by an existing, but modified, septic tank located above the bay. Settled sewage then passes into the mechanically aerated first lagoon which reduces the pollution load by oxidizing organic matter. The oxidized liquid is pumped to a sprinkler system installed on the peninsula where the existing vegetation and top soil absorbs the greatest part of the organic matter and nutrients. From the peninsula, the water filters through 5 to 35 feet of sandy sub-soil, and flows into the second 60-acre lagoon for polishing before emptying into the Ouaureau River. (Sandoski-FIRL)  
W76-08033

**TWO-STAGE BIOLOGICAL TREATMENT OF A DIFFICULT WASTEWATER MIXTURE,**  
Carollo (John) Engineers, Walnut Creek, Calif.  
G. W. Knopf.  
Public Works, Vol. 104, No. 8, p 89-92, August, 1973. 1 fig, 2 tab.

Descriptors: \*Waste water treatment, \*Treatment facilities, \*Biological treatment, Domestic wastes,

Industrial wastes, Activated sludge, Filters, Aeration, Sewers, Toxicity, California.  
Identifiers: Clarifiers, Plastic media roughing filter.

San Pablo Sanitary District's (California) new \$4.4 million treatment plant expansion is providing reliable and efficient treatment for a difficult-to-treat mixture of domestic and industrial waste water. The main reason for the success of the new plant additions is a two-stage biological treatment plant incorporating the use of a roughing filter prior to conventional activated sludge treatment. The basic concept of this type of treatment plant was to protect the activated sludge portion of the plant from toxic shock loads. This was accomplished by the use of a plastic media roughing filter located between the primary clarifiers and the aeration basins. The performance of this plant has proven the concept to be an effective means of protecting the bio-mass in the aeration. On several occasions since plant start-up, toxic materials discharged to the sewer have stripped the bio-mass from the filter; however, the activated sludge was unaffected due to protection provided by the roughing filter. The plant is to be developed in two phases. Initially, the facility is to provide for an average wet weather flow of 16.5 mgd. Phase 2 additions will raise the average wet weather treatment capacity to 24.5 mgd. (Sandoski-FIRL)  
W76-08034

**APPLICATION OF SYSTEM ANALYSIS IN TWO-STAGE REVERSE OSMOSIS PROCESS DESIGN FOR WATER DESALINATION,**  
National Research Council of Canada, Ottawa, Division of Chemistry.  
For primary bibliographic entry see Field 3A.  
W76-08076

### 5E. Ultimate Disposal Of Wastes

**DISPOSAL OF LIQUID WASTES BY CHEMICAL FIXATION,**  
J. R. Conner.

Waste Age, Vol. 5, No. 6, p 26-27, 30, 33, 35-38, 42, 44-45, September, 1974. 10 fig, 11 tab, 7 ref.

Descriptors: \*Liquid wastes, \*Ultimate disposal, Leachates, Industrial wastes, Chemical wastes, Waste disposal, Land reclamation.

Identifiers: \*Chemical fixation, \*Chemfix process, Cost-effectiveness.

New approaches to dealing with the ultimate disposal of industrial wastes involve chemical fixation and solidification. A number of chemical systems react with various wastes to form solids which encapsulate, immobilize or otherwise tie up the waste. These may be organic processes such as asphalt tar, polyolefins, and epoxies, or they may be inorganic processes such as Portland cement, lime-based mortars, and lime-pozzolan cements. About five years ago, the Chemfix process was developed for the chemical fixation and solidification of complex waste mixtures; it produces a non-toxic environmentally-safe material that can be used as landfill. The Chemfix process, now patented is a two-part, inorganic system which reacts with all polyvalent metal ions and certain other waste components and which also reacts within itself to form a chemically and mechanically stable solid. The system is based on the reactions between soluble silicates and silicate setting agents which form a solid matrix. (Orr-FIRL)  
W76-07500

**RECENT INVESTIGATIONS INTO THE DISPOSAL OF TANNERY WASTE WATER,**  
Institut TNO voor Leder en Schoenen, Waalwijk (Netherlands).

For primary bibliographic entry see Field 5D.  
W76-07506

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5E—Ultimate Disposal Of Wastes

**INCINERATION GIVES NEAT ANSWER TO PHARMACEUTICAL WASTES DISPOSAL PROBLEMS.**  
Process Engineering, p 68-69, April, 1974. 1 fig.

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Waste disposal, \*Incineration, Chemical wastes, Fuel, Ultimate disposal, Waste water disposal.  
Identifiers: Heat recovery, \*Pharmaceutical wastes.

An incineration and heat recovery process was designed to work economically. This waste disposal system was installed for a British pharmaceutical and chemical company which produces over 60 tons/day of aqueous wastes. The wastes are lean in caloric value and contain about 80 to 90% water. Fuel is saved when liquid feed from the plant is fed into a concentrating unit which is split into two phases, water vapor and organics, with a smaller liquid phase containing phosphoric acid. This unit is fired by fuel oil. A conventional John Zink ZTO incinerator then burns the liquid phase, using considerably less fuel oil because of the reduced water content. The gases from the incinerator are cooled and scrubbed to remove inorganic compounds. They are then routed to a packed bed unit to remove hydrochloric acid. With this system, about 10 million Btu/hr (40% of the heat input) is recovered in the waste heat boiler as 10,000 lb/hr of 150-psi steam. The process equipment costs are only 30% greater than a conventional incinerator. As fuel oil prices increase, this type of waste disposal system should become increasingly profitable. (Murphy-FIRL)  
W76-07529

**TREATMENT AND DISPOSAL OF WASTE-WATER FROM ONION DEHYDRATION FACTORY AT SATPUR, NASIK,**  
Maharashtra Engineering Research Institute, Nasik (India).  
For primary bibliographic entry see Field 5D.  
W76-07533

**REVERSE-OSMOSIS SYSTEM FACILITATES DISPOSAL OF USED CUTTING OILS.**  
For primary bibliographic entry see Field 5D.  
W76-07628

**TREATMENT OF EFFLUENTS,**  
For primary bibliographic entry see Field 5D.  
W76-07650

**THE CONSTRUCTION OF AN INDUSTRIAL WASTE WATER DISCHARGE PIPE SYSTEM INTO THE SEA (BAU EINER INDUSTRIEABWASSER-LEITUNG INS MEER),**  
G. Brux.  
Baumaschine und Bautechnik, Vol. 20, No. 11, p 447-448, November, 1973. 7 fig, 5 ref.

Descriptors: \*Waste water disposal, \*Industrial wastes, \*Pipelines, Plastic pipes, Chemical industry, Concrete, Construction materials, Waste disposal, Waste water treatment.  
Identifiers: Waste discharge pipes.

The construction of a pipe system, designed to discharge waste waters from a chemical plant in France into the sea, is described. The submerged section of the pipe system, more than 300 meters in length, is composed of a polyethylene pipe with a 1,200 mm outside diameter, connected to the ground pipe of 800 mm diameter. A nylon fabric hose, placed inside the polyethylene pipe, was filled with colloidal concrete mortar by injection through a narrow passage that served as a ballast. This reduced the inside diameter of the underwater pipe section to that of the land section to facilitate construction. (Takacs-FIRL)  
W76-07658

**EFFECT OF TEMPERATURE ON CANNERY WASTE OXIDATION,**  
North Texas State Univ., Denton. Dept. of Microbiology.  
For primary bibliographic entry see Field 5D.  
W76-07662

**SLUDGE INCINERATION AND PRECIPITANT RECOVERY, VOLUME I, A SELECTIVE CODED BIBLIOGRAPHY,**  
Department of the Environment, Ottawa (Ontario).  
D. Plummer.

Research Report No. 31, Training and Technology Transfer Division (Water), Environmental Protection Services, Environment Canada, Ottawa, Canada, February 1976, 31 p., 193 ref., 11 tab. 72-3-4.

Descriptors: \*Sewage, \*Sludge, \*Sewage disposal, Incineration, Iron, Lime, Dewatering, Effluents, Bibliographies, Publications, Water pollution control, Waste treatment.  
Identifiers: \*Precipitant recovery, Alum, Sludge conditioning.

Incineration has been a popular method of ultimate disposal of sewage sludges for many years. With the recent implementation of chemical phosphorus removal programs at municipal wastewater treatment plants, interest has developed in the recovery and recycle of the chemical precipitants (alum, iron, and lime) from incinerated sludge ash. The Wastewater Technology Centre of the Environmental Protection Service initiated a 'Sludge Incineration and Precipitant Recovery Program' in 1972. An extensive review of the related significant English language literature from the period 1968 to 1974 was performed as part of this program and is summarized in this bibliography. (Environment Canada)  
W76-07678

**SOME COMMENTS ON PROBLEMS OF WASTE DISPOSAL IN THE METAL FINISHING INDUSTRY.**

Transactions of the Institute of Metal Finishing, Vol. 53, No. 4, p 197-200, 1975.

Descriptors: \*Metals, \*Waste disposal, Waste water treatment, Dyes, Sludge, Industrial wastes, Dewatering, Water pollution control, Legislation.  
Identifiers: \*Metal finishing industry wastes.

General waste disposal problems in the metal finishing industry in Great Britain are discussed. Typical wastes requiring special disposal are the spent or contaminated process solutions and the sludges formed either during process operations or in the course of effluent treatment. Recovery of valuable metals from process solutions or sludges which contain large quantities of one metal should be considered. Such solutions include static rinses, contaminated plating solutions, pickling solutions for metals other than ferrous metals or aluminum, strippers for nickel, copper, cadmium and precious metals, and etches for copper. Costs of operating a recovery process must be compared with related savings in disposal costs. In cases where toxic and corrosive wastes are disposed of rather than recycled, new legislation such as the Deposit of Poisonous Wastes Act of 1972 governs their collection, removal, and deposit. Under this Act, wastes must be declared and analyzed; following completion of removal and deposit, local authorities must again be notified. Disposal costs include waste disposal site charges and transportation costs, and varying according to the nature of the waste and the distance of transport. Wastes of low toxicity are discharged into unused quarries, sand or clay pits, while such wastes as pickle acids and spoiled chrome solutions may be discharged only to controlled sites, where they will not degrade the quality of ground or surface waters. (Kramer-FIRL)

W76-07754

**NEBRASKA DISPOSAL WELLS REGULATIONS.**  
Nebraska State Dept. of Environmental Control, Lincoln.  
For primary bibliographic entry see Field 5G.  
W76-07801

**REGISTRATION OF LIQUID WASTE HAULERS AND WASTE DISPOSAL TO LAND,**  
For primary bibliographic entry see Field 5G.  
W76-07802

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION CONCENTRATED ANIMAL FEEDING OPERATIONS.**  
Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07846

**OCEAN DUMPING.**  
For primary bibliographic entry see Field 6E.  
W76-07860

**4000-FOOT OUTFALL HAS 640-FOOT DIFFUSER FOR OCEAN DISPERSAL.**  
The American City, Vol. 88, No. 6, p 96, June, 1973. 1 fig.

Descriptors: \*Outfall sewers, \*Treatment facilities, \*Sewage disposal, Construction, Pipes, Linings, Coatings, Atlantic Ocean, Waste water treatment, Sewage treatment, Construction materials, Joints(Connctions), Concrete pipes, Diffusion.

Identifiers: Monmouth County(NJ), \*Ocean disposal.

Monmouth County, New Jersey, is sending its sewage 4000 feet into the Atlantic Ocean to a 640-foot long submerged diffuser. The new underwater outfall will lie more than a dozen communities, three sewer districts, and three treatment plants into the Monmouth County Bayshore Outfall Authority system. The outfall, 5360 feet long, is being constructed of steel pipe provided by Bethlehem Steel Corporation for the river section, the 48-inch pipe is lined and coated with coal tar enamel and double felt wrapped. For the ocean section, the pipe is lined and coated with two coats of epoxy. A concrete coating is sprayed on the outside to facilitate sinking the pipe into position. Assembled on a specially designed rubber-wheeled conveyor track, the pipe lengths are welded into 600-foot sections. Joints are bell and spigot double lap-welded. (Sandoski-FIRL)  
W76-08002

**BOCA RATON'S NEW WASTEWATER TREATMENT PLANT,**  
For primary bibliographic entry see Field 5D.  
W76-08021

**A SURVEY OF CHIBA MUNICIPAL CENTRAL SEWAGE TREATMENT PLANT (CHIBA-SHI CHUO GESUI SHORIJO NO GAIYO),**  
Chiba Municipal Government, (Japan). Bureau of Construction.  
For primary bibliographic entry see Field 5D.  
W76-08022

**EVALUATION OF GROUND-WATER CONTAMINATION FROM CLEANING EXPLOSIVE-PROJECTILE CASINGS AT THE BANGOR ANNEX, KITSAP COUNTY, WASHINGTON, PHASE II,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 5B.  
W76-08048

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

#### 5F. Water Treatment and Quality Alteration

**OZONE IN DRINKING WATER PREPARATION (OZON IN DER WASSERAUFBEREITUNG),**  
G. E. Kurzmann.  
Chemische Industrie, Vol. 26, No. 8, p 502-503, August, 1974.

Descriptors: \*Ozone, \*Oxidation, \*Water treatment, \*Potable water, Viruses, Disinfection, Metals, Phenols, Chemical industry, Food processing industry.

The uses and efficiency of ozone in water purification and sterilization are surveyed. Ozone is used mainly for the destruction of pathogenic germs and for the inactivation of viruses in springwater, groundwater and surface water for drinking-water preparation. The rate of sterilization can be increased, and the specific ozone consumption can be reduced by the combination of this oxidant with polyphosphates. Rapid and highly efficient oxidation of lead, iron, cadmium, manganese, and mercury ions is possible by ozonization. Carcinogenic polycyclic aromatic hydrocarbons, present in surface waters in concentrations of 10-100 microgram per cu m, and in concentrations of 1-10 microgram per cu m in groundwater, are destroyed by ozone at efficiencies reaching up to 99.8%. The ozone oxidation products of pesticide residues in water are, however, not necessarily less toxic than the original compounds. Cyanogen and phenol are destroyed by ozone in waste water. Ozonation as a purification process can be employed for the sterilization of purified waste water, and in water preparation for bottling and pharmaceutical plants, and in oyster and shellfish beds. (Takacs-FIRL)

W76-07501

**TERRITORY, INDUSTRIAL PLANTS, WATER SUPPLY, AND WASTE WATER PLANTS-PARTNERS IN JOINT INVESTMENTS (TERRITORIUM, INDUSTRIEBETRIEB UND VEB WAB-PARTNER GEMEINSAMER INVESTITIONEN),**  
For primary bibliographic entry see Field 5D.

W76-07669

**INVENTORY OF CANADIAN COMMERCIAL SHIPS ON THE GREAT LAKES.**  
For primary bibliographic entry see Field 5D.

W76-07682

**SELECTED BIBLIOGRAPHY ON OZONE DISINFECTION,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate. For primary bibliographic entry see Field 5D.

W76-07683

**AN OUTBREAK OF SHIGELLA SONNEI GASTROENTERITIS ON COLORADO RIVER RAFT TRIPS,**  
Center for Disease Control, Atlanta, Ga.  
For primary bibliographic entry see Field 5C.

W76-07691

**DYNAMICS OF THE PURIFICATION OF DOMESTIC FECAL SEWAGE ON SEWAGE FARMS, (IN RUSSIAN),**  
Nauchno-Issledovatel'skii Institut Epidemiologii, Mikrobiologii i Gigieny, Vilnius (USSR). For primary bibliographic entry see Field 5D.

W76-07692

**THE WATER SUPPLY OF ROME,**  
College of Physicians of Philadelphia, Pa.  
For primary bibliographic entry see Field 4A.

W76-07819

#### RUBBER ROOF PROTECTS WATER FROM POLLUTANTS.

The American City, Vol. 88, No. 6, p 33, June, 1973. 2 fig.

Descriptors: \*Reservoirs, \*Rehabilitation, Water treatment, Plastics, Chemicals, Construction materials, Chlorination, Water pollution control, Tennessee.

Identifiers: Chlorine depletion, Bacterial contamination, Reservoir covers, Hypalon.

Along with rehabilitation of Alcoa, Tennessee's two 50-year old hilltop reservoirs, the city had covers installed to check loss by evaporation, reduce chlorine depletion due to sunlight, and cut the potential for pollution. The covers, manufactured by Burke Rubber Company, San Jose, California, consisted of a 5-ply, 45-mil sandwich of Hypalon, a product of Du Pont, Incorporated, and nylon reinforcing fabric. This synthetic rubber/nylon sandwich is resistant to sunlight and weathering, mold, mildew, and fungus. Of particular importance in this application, the cover is resistant to chemicals required for water treatment. For installation, the rubber sheets arrive at the site in accordion-folded rolls packed on pallets. The rolls are positioned in their programmed locations at the top of the reservoir slope, unrolled to the bottom, and unfolded to full width. Next, 4 x 12-inch plastic foam planks are placed into their flotation sleeves and seamed. These planks provide the cover with stabilization and flotation as well as channel rainwater runoff to the periphery. Once the cover is secured in place, a foot of water/chlorine solution as admitted to the reservoir to treat the floor of the area and the underside of the cover against bacterial contamination. When this solution is drained, the reservoir is gradually filled, and placed into service. (Sandoski-FIRL)

W76-08003

#### WATER FLOW BINDING. TRY RELINING.

Los Angeles Memorial Coliseum and Sports Arena, Calif.

W. H. Nicholas.

The American City, Vol. 38, No. 7, p 42, July, 1973. 2 fig.

Descriptors: \*Pipelines, \*Construction, Flow characteristics, Linings, Cleaning, Water distribution(Applied), Water supply.

Identifiers: Renovation, \*Pipeline repair.

In-place renovation, which effectively restored the original flow characteristics and performance of 2910 feet of 42-year-old transmission and distribution pipelines, has been accomplished at the Los Angeles Coliseum. To do the job, the Coliseum Commission called in a team of seven men from the Ameron, Incorporated Pipe Lining Division of Wilmington, California. To gain access to the pipelines, nipples were cut to accept the half-inch steel cable and the cleaning and lining apparatus. The lining was installed with Ameron's "Spunline" applicator, pressure fed to ensure uniformity of coating. Hoses through which the mortar was pumped were elevated up to 50 feet and extended as long as 350 feet from the mixing units located at ground level outside the coliseum. (Sandoski-FIRL)

W76-08013

**NEW AUTOMATED SYSTEM SUCCESSFULLY HANDLES BULK CHEMICALS AT POTOMAC RIVER FILTRATION PLANT,**  
Water and Sewage Works, Vol. 120, No. 7, p 49, July, 1973.

Descriptors: \*Automation, \*Treatment facilities, Lime, Storage, Flow, \*Filtration, Potomac River, \*Water treatment, Equipment, Gravimetry, Maryland.

Identifiers: Activators, \*Potomac River Water Filtration Plant, Alum, Chemical treatment.

Installation of vibrated bin activators eliminated a major obstacle to the successful operation of a new automated chemical storage and feeding facility at the Potomac River Water Filtration Plant of the Washington Suburban Sanitary Commission, Montgomery County, Maryland. To insure uninterrupted flow of the alum and lime, consulting engineers specified installation of a seven-inch diameter Vibra Screw bin activator on each storage bin. Material is drawn from the bins into gravimetric feeders. The bin activators are flexibly hung from the bin by rubber fitted, forged steel hangers. A flexible reinforced rubber sleeve seals the small gap between the bin and the movable bottom. An integral baffle relieves headload over the discharge outlet. Mounted on the bin activator, and riding with it, is a patented oil lubricated gyror. The vibratory action of the Vibra Screw bin activator has completely eliminated flow stoppage. Consistent flow of lime and alum to the feeders has enabled them to maintain an accuracy of within one percent of the set rate. (Sandoski-FIRL)

W76-08015

#### WATER TREATMENT COMPOSITION INCLUDING SYNTHETIC WAX.

Tesco Chemicals, Inc., Atlanta, Ga. (Assignee).

J. L. Halley.

United States Patent 3,753,676. Issued August 21, 1973. Official Gazette of the United States Patent Office, Vol. 913, No. 3, p 904, August 21, 1973.

Descriptors: \*Water treatment, Chlorine, Inhibitors, Plant growth regulators, Bacteria, Algal control, \*Patents, \*Chlorination.

Identifiers: Cyanuric acid, Fatty diamide synthetic wax.

A water treatment composition which comprises a water soluble chlorine containing compound or blend of compounds, optionally cyanuric acid, a water insoluble fatty diamide synthetic wax, and optionally a molding lubricant, is effective in inhibiting the growth of bacteria, algae, and other plant life in water when the composition is blended together and shaped into dosage unit form. The composition maintains its configuration during exposure to water and retains undesirable insolubles, while permitting the leaching of chlorine from the unit by the action of water upon the composition. (Sandoski-FIRL)

W76-08029

**APPLICATION OF SYSTEM ANALYSIS IN TWO-STAGE REVERSE OSMOSIS PROCESS DESIGN FOR WATER DESALINATION,**  
National Research Council of Canada, Ottawa, Division of Chemistry.

For primary bibliographic entry see Field 3A.

W76-08076

**PUBLIC HEALTH ASPECT OF TROPICAL WATER RESOURCES DEVELOPMENT,**  
Nigeria Univ., Nsukka. Dept. of Civil Engineering. For primary bibliographic entry see Field 5G.

W76-08096

## 5G. Water Quality Control

**CLAM SURVIVAL IN CHLORINATED WATER,**  
Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.

L. J. Tilly.

Available from the National Technical Information Service, Springfield, Va 22161, as DP-1398, \$3.50 in paper copy, \$2.25 in microfiche. DP-1298, January, 1976, 9 p, 2 fig. AT(07-2)-1.

Descriptors: \*Clams, \*Chlorine, \*Chlorination, Mortality, Water pollution control, Wells.

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

Identifiers: \*Survival, Savannah River Plant(SC).

Populations of clams had been colonizing the suction wells of circulation pumps to an extent where flow of coolant water through the pumps and heat exchangers of the Savannah River Plant production reactors was restricted. An existing chlorination method was applied to water in a suction well in which both wall- and floor-dwelling clams were found. After clams were removed from chlorine exposures (10-40ppm) of 9, 17, 25, and 54 hours, respective survivals after seven days in a recovery chamber were 97%, 84%, 47%, and 10%. Accumulated mud on the floors and walls of the basin protected large numbers of clams from lethal chlorine exposures. Of the clams thus protected, 65% were alive after seven days in the recovery chamber. (Chilton-ORNL)  
W76-07481

**ACID STRIP MINE LAKE RECOVERY,**  
Missouri Univ., Columbia, Dept. of Civil Engineering.  
D. L. King, J. J. Simmler, C. S. Decker, and C. W. Ogg.  
Journal Water Pollution Control Federation, Vol. 46, No. 10, p 2301-2315, October, 1974. 11 fig., 1 tab, 20 ref. OWRT A-038-MO(3).

Descriptors: \*Waste water treatment, \*Industrial wastes, \*Acid mine water, Mining, Waste assimilative capacity, \*Mine drainage, Lakes.

The recovery of acid mine drainage contaminated lakes to an alkaline condition capable of supporting entire aquatic communities at a level characterized as early eutrophy is discussed. Recovery of acid strip mine lakes is described as a natural succession resulting from gradual decreases in acid production by the spoils and leachate from unmined portions of the watershed and the leaves, grass, and other organic material in the runoff from unmined land eventually accumulating in such lakes to a concentration that is sufficient, allows sulfate reduction. Experimental studies were performed where organic matter was added to acid strip mine lake microcosms. Sawdust, wheat straw, leaves, newspaper, cattle manure and both raw and digested waste water sludge all served as suitable substrates for recovery. Green leaves produced a final state of tea-colored water with many of the characteristics of bog lake water. The other organics used produced a clear alkaline water after the recovery process was completed. The advantages of accelerating the natural process to recover acid strip mine lakes include the elevation of pH, loss of acidity and metals, and significant sulfate loss without creating a chemical sludge disposal problem. Another significant advantage is that organic wastes serve as the raw material for the process. The major disadvantage, the evolution of hydrogen sulfide to the atmosphere may be limited by controlling the amount of organic wastes added to the lake. (Orr-FIRL)  
W76-07499

**ACID DRAINAGE CONTROL AND WATER TREATMENT AT HEATH STEELE,**  
Heath Steele Mines Ltd., Newcastle, (New Brunswick).  
For primary bibliographic entry see Field 5D.  
W76-07512

**FACTORS AFFECTING WATER QUALITY FROM STRIP-MINED SITES,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Agricultural Engineering; and Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5B.  
W76-07528

**FISH GROWTH RESPONSE TO MECHANICAL MIXING OF LAKE ARBUCKLE, OKLAHOMA,**  
Oklahoma Cooperative Fishery Unit, Stillwater.  
For primary bibliographic entry see Field 5C.  
W76-07587

#### REFERENCE GUIDE TO METHODOLOGY FOR THE ANALYSIS OF ORGANIC COMPOUNDS.

Geological Survey, Bay St. Louis, Miss.  
For primary bibliographic entry see Field 5A.  
W76-07590

#### SURVEY OF IRRIGATION CANAL ECOLOGICAL PARAMETERS INFLUENCING AQUATIC WEED GROWTH,

Bureau of Reclamation, Denver, Colo. Engineering and Research Center.  
For primary bibliographic entry see Field 4A.  
W76-07609

#### FRESHWATER BIOLOGY AND POLLUTION ECOLOGY: TRAINING MANUAL.

Environmental Protection Agency, Cincinnati, Ohio. Office of Water Programs Operations.  
For primary bibliographic entry see Field 5C.  
W76-07611

#### INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF PARATHION.

Midwest Research Inst., Kansas City, Mo.  
Available from the National Technical Information Service, Springfield, Va 22161, as PB-241 819, \$9.25 in paper copy, \$2.25 in microfiche. EPA-540/1-75-001, January 1975. 4 fig., 42 tab., 409 ref. EPA 68-01-2448

Descriptors: \*Pesticides, \*Evaluation, \*Performance, \*Reviews, Formulation, Birds, Degradation(Decomposition), Effects, Mites, Insects, Pesticide residues, Toxicity, Resistance, Hazards, Safety, Crop response, Metabolism, Costs, Animal pathology, Benefits, Human pathology, Aquatic life, Wildlife, Food chains, Lethal limit.  
Identifiers: \*Parathion, Pharmacology.

The efficacy and safety of parathion as a possible replacement for the pesticide DDT is reviewed. The synthesis and chemical properties of parathion are described. It is available in many registered formulations and physical forms. Parathion has a broad spectrum of effectiveness against insects and mites. Pharmacological and toxicological studies show that it is toxic to all species studied by all routes of administration; it causes the irreversible binding of paroxon to cholinesterase. Tolerances for parathion residues have been established for about 100 raw agricultural commodities. The acceptable daily intake has been set at 0.005 mg/kg body weight. The major hazard of parathion use is its acute toxic hazard to man and higher organisms. Limitations of available scientific data are listed. Efficacy data are presented for numerous crop-pest combinations. Cost effectiveness is demonstrated for three major cotton, two sorghum, one wheat, two corn, three potato, and three vegetable/fruit pests. This review is a compilation and summarization of available material, rather than an interpretation, of published and unpublished scientific and use data from various sources. (Buchanan-Davidson-Wisconsin).  
W76-07612

#### A WATER QUALITY CONTROL PROGRAM,

Publishers Paper Co., Oregon City, Oreg.

For primary bibliographic entry see Field 5D.  
W76-07642

#### PROBLEMS RELATED TO THE RENEWED GROUNDWATER LEVEL RISE IN PREVIOUS

**MINING AREAS AS ILLUSTRATED BY THE SOUTHERN LUSATIA EXAMPLE (PROBLEME DES GRUNDWASSERWIEDERANSTIEGS IN EHEMMLIGEN BERGBAUEBieten AM BEISPIEL DER SUED-LAUSITZ),**  
For primary bibliographic entry see Field 5B.  
W76-07663

**THE WATER AND TOTAL OPTIMIZATIONS OF WET AND DRY-WET COOLING TOWERS FOR ELECTRIC POWER PLANTS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 3E.  
W76-07674

#### TWO TRILLION OR THREE: THE COST OF WATER QUALITY GOALS,

New York State Dept. of Environmental Conservation, Albany.

D. F. Metzler, and F. O. Bogedain.  
In: Proceedings of a National Symposium on Costs of Water Pollution Control, April 6-7, 1972, Water Resources Research Institute, North Carolina State Univ., Raleigh, p. 17-28. 2 fig., 7 tab., 3 ref.

Descriptors: \*Water quality standards, \*Costs, \*Water pollution control, \*Tertiary treatment, Economic impact, Estimated costs, Water policy, Pollution abatement.  
Identifiers: \*Zero discharges.

The concept of 'zero discharge' as a water pollution control measure is evaluated in relation to estimated costs and the consequent economic impact. By applying Robert Smith's compilation of cost information for conventional and advanced wastewater treatment, capital and operating costs are estimated for 100% BOD and SS removal from New York State's wastewaters as \$239.5 billion; also a distinction is made between 100% removal and 'zero discharge,' as the latter would include costs for land and conveyances for disposal. The figure for land costs is computed at \$3.6 billion. It is proposed that instead of setting very high water quality goals and providing funding for lesser objectives, a national effort be made to develop comprehensive sewage facility plans. These plans would evaluate alternative solutions for secondary, tertiary, and complete levels of waste treatment as a mechanism for determining the costs and benefits of each alternative, and then could be used in guiding a decision as to national standards, or in fact, whether national standards are desirable. The approximate costs of achieving national treatment goals of 'zero discharge' as proposed in S. 2770 would range up to 3 trillion dollars over a 25 year period and up to several hundred billion in New York State alone. (See also W74-05629) (Auen-Wisconsin)  
W76-07686

#### COST EFFECTIVENESS OF REGIONAL WATER QUALITY MANAGEMENT: SOME SELECTED CASE STUDIES AND GENERAL IMPLICATIONS,

Manhattan Coll., Bronx, N. Y. Dept. of Civil Engineering.

R. V. Thomann.  
In: Proceedings of a National Symposium on Costs of Water Pollution Control, April 6-7, 1972, Water Resources Research Institute, North Carolina State Univ., Raleigh, p. 57-66. 4 fig., 3 tab., 6 ref.

Descriptors: \*Water pollution control, \*Economic efficiency, \*Sewage treatment, \*Marginal costs, Organic wastes, Sewage effluents, Atlantic Coastal Plain, Dissolved oxygen, Regional analysis, New York, Massachusetts, Delaware River.  
Identifiers: \*Zero waste discharge, Boston Harbor(Mass), New York Harbor(NY), Delaware Estuary(Del.).

## WATER QUALITY MANAGEMENT AND PROTECTION—Field 5

### Water Quality Control—Group 5G

It is postulated that it would be fallacious to ignore the interaction between biodegradable organic waste discharges and water quality in order to institute waste treatment programs based solely on arbitrary waste effluent and water quality standards. To substantiate the lack of cost efficiency, the water quality responses of the highly urbanized Boston Harbor, New York Harbor, and the Delaware Estuary, to three treatment levels are calculated and shown to be about 0.1-0.5 mg/l DO increase for every 100,000 lb/day removed by a treatment program and the marginal increase in DO at the upper levels of treatment would be about 0.1-0.2 mg/l. Cumulative DO responses would be about 2-3 mg/l, primarily resulting from treatment upgraded to the secondary with nitrification level. It is estimated that it would cost about \$200-250 million annually to go from secondary with nitrification to 99% removal. The water quality improvement for this expenditure would be less than 0.5 mg/l DO with the result that these regions would be spending about \$50 million annually for a 0.1 mg/l DO improvement with no potential for new uses of these waters. If these metropolitan regions were forced to install ultimate treatment (if technologically possible) an annual \$200 million would be inefficiently spent. (See also W74-05629) (Auen-Wisconsin)  
W76-07687

#### WATER RESOURCES ISSUES AND THE 1972 UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT,

Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

W. H. Matthews.

In: Proceedings of a National Symposium on Costs of Water Pollution Control, April 6-7, 1972, Water Resources Research Institute, North Carolina State Univ., Raleigh, p. 136-148. 1 fig.

Descriptors: \*United Nations, \*Conferences, Water resources, \*Environment, Social aspects, Institutions, Natural resources, International waters, Pollution abatement.

Identifiers: International cooperation.

The objectives of the conference were related to the improvement of human settlements and health; development and use of fresh water, land and energy resources; harmonizing development goals and social and cultural values with environmental quality objectives; and protection of living resources, and of the oceans, and avoidance of inadvertent climate modifications, which evolved in an Action Plan. Water quality concern emerged as the central issue, yet this concern was accompanied by uneasiness over the concept of water quality standards, lest efforts to achieve such standards constrain economic progress or divert investment from development priorities to pollution abatement. The emphasis of the Action Plan at the international level was on assessment-research, monitoring, and information exchange—not on international control and regulation. In essence, this reflected a political willingness to recognize the potential seriousness of environmental problems but a reluctance to act decisively on control based on what policy makers understood about these problems and their implications. The political consensus on assessment rather than on the institution of effective management approaches was because the policy makers were not aware of much of the scientific and technical work that was already available. The desire for more knowledge is explicit—the willingness to act on it when it is obtained is implicit. (See also W74-05629) (Auen-Wisconsin)  
W76-07688

#### FINANCING AND CHARGES FOR WASTE-WATER SYSTEMS: ACTIVITIES OF THE JOINT WPCF/ASCE/APWA COMMITTEE,

Hazen and Sawyer, New York.

C. R. Walter.

In: Proceedings of a National Symposium on Costs of Water Pollution Control, April 6-7, 1972, Water Resources Research Institute, North Carolina State Univ., Raleigh, p. 168-171.

Descriptors: \*Waste water treatment, \*Income, \*Rates, Taxes, Cost repayment, Sewage treatment, Financing, Pollution abatement.

Identifiers: Joint WPCF/ASCE/APWA Committee.

A summation of the 1972 draft report of the Joint Water Pollution Control Federation/American Society of Civil Engineers/American Public Works Association Committee discusses the principle for determining revenue for a waste water treatment system. The basic philosophy is that both users and non-users should pay for a treatment system in proportion to their use and/or their benefit and that the system's operation should be self-sustaining. Equitable use rates should be based on a specific parameter—BOD, suspended solids, settleable solids—and that parameter used as a surcharge rather than as a basic charge. Thus dischargers whose effluents impose costs exceeding the average would be charged for that excess on a fair basis; but unless it is an extremely strong waste, the basic charge would be determined by the rate of flow. When a new community is provided with sewer system, property taxes are the usual way—but not the only—equitable method to generate revenues. A good portion of the charge must be included in the tax because a new development does not have enough users for the excess capacity provided. The tax base of fully developed municipalities should also support the waste treatment system. (See also W74-05629) (Auen-Wisconsin)  
W76-07689

#### PUBLIC PERCEPTION OF POLLUTION CONTROL,

Council on Environmental Quality, Washington, D.C.

R. Cahn.

In: Proceedings of a National Symposium on Costs of Water Pollution Control, April 6-7, 1972, Water Resources Research Institute, North Carolina State Univ., Raleigh, p. 210-217.

Descriptors: \*Pollution abatement, \*Attitudes, \*Social value, Environment, Judicial decisions, Legislation, Social participation.

Identifiers: \*Quality of life.

Environmental activists have induced legislation and court decisions at the federal and state levels and the general public appears to be increasing its perceptions of the quality of life, but the public does not yet have sufficient awareness of the comprehensiveness of the environmental problems, how to solve them, and a willingness to expend the effort. Some results of public polls indicated that on a scale of \$10, \$50, and \$100 tax for environmental improvement, only 8% were willing to pay \$100 or more and only 29% were willing to pay \$100 or more for a pollution-free car. The inference of the polls was that the public is really not willing to pay the cost of cleaning up pollution. Research, education, business leaders, and individuals should increase public perception of the total costs and benefits of environmental quality so that all actions would be considered in relation to their impact on the environment. The public must also face the larger issues of the quality of life as exemplified in the debate on the limits to growth, income distribution, and effective allocation of depletable resources. (See also W74-05629) (Auen-Wisconsin)  
W76-07690

#### INTENSIFIED FISH CULTURE COMBINING WATER RECONDITIONING WITH POLLUTION ABATEMENT,

Kramer, Chin and Mayo, Seattle, Wash.

P. B. Liao, and R. D. Mayo.

Aquaculture, Vol. 3, No. 1, p. 61-85, February, 1974. 13 fig., 2 tab., 27 ref.

Descriptors: \*Fish hatcheries, \*Aquaculture, Water pollution sources, \*Water pollution control, \*Pollution abatement, Water reuse, \*Recirculation water, \*Fish toxins, \*Nitrates, Water quality, Fish farming, Fish handling facilities, Fisheries, Commercial fish, Water conservation, Nitrogen compounds, Waste water(Pollution).

Identifiers: \*Water reconditioning.

Demand for game and commercial fish has increased and the decreased availability of good quality water has stimulated efforts to obtain more fish production with less water. The pollution potential of fish hatcheries requires proper control. Water reconditioning and reuse can provide pollution abatement and increase a hatchery's fish carrying capacity tenfold as compared to a single pass system. Requirements for removal of ammonia, nitrite and solids are discussed after an examination of various water reconditioning systems. (Katz)  
W76-07711

#### WILL INDUSTRY MEET WATER QUALITY REQUIREMENTS,

G. Dallaire.

Civil Engineering-ASCE, Vol. 45, No. 12, p 68-72, December 1975. 4 fig.

Descriptors: \*Cost-benefit analysis, \*Economic impact, \*Environmental control, Laws, Legislation, Environmental impact, Water quality, Water requirements.

Identifiers: \*Water Pollution Control Act Amendments of 1972, \*National Commission on Water Quality, Best practicable technology(BPT), Best available technology(BAT), Biological oxygen demand.

Preliminary findings of the National Commission on Water Quality study to determine the impact of the Water Pollution Control Act Amendments of 1972 on American industry are outlined. In the Act certain requirements were to be fulfilled by 1977 and 1983. By 1977 the best practicable technology (BPT) is to be installed, and by 1983 the best available technology (BAT) must be used. Some of the findings were: with few exceptions industry will experience long-run price increases due to 1977 BPT standards; 1983 BAT standards will produce greater long-run price increases; plant closures are significant in 6 industries—pulp and paper, metal finishing, textiles, fruits and vegetables, feedlots, and meat packing; BPT will have a greater economic impact on industry than BAT; regional impacts are concentrated in the Northeast, and to a lesser extent, in the Mid-Atlantic and North Central regions; shortage of capital and manpower could hinder industry's abilities to meet BPT by 1977. Industry argues that a pause is necessary after 1977 to assess costs vs. benefits. Skyrocketing costs as zero discharge is approached is cited as an example. Industry questions the wisdom of a blanket requirement for BAT, saying economic cost vs. environmental benefits should be weighed. The Commission did not question the 1983 BAT requirements but advocated it be moved back to 1985. Key benefits from meeting the law's goals are: better water quality raises property values near water; reopened beaches stimulate economic activity; increased commercial and recreational fishing in marine waters; increased freshwater fishing. (Gentry - North Carolina)  
W76-07736

#### SOME COMMENTS ON PROBLEMS OF WASTE DISPOSAL IN THE METAL FINISHING INDUSTRY.

For primary bibliographic entry see Field 5E:

W76-07754

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

PROCEEDINGS: LAKE TAHOE RESEARCH SEMINAR II, 27 SEPTEMBER 1974, SANDS VAGABOND CONVENTION CENTER, SOUTH LAKE TAHOE, CALIFORNIA,  
Lake Tahoe Area Research Coordination Board  
South Lake Tahoe, Calif.  
Available from the National Technical Information Service, Springfield, Va 22161, as PB-240 549, \$5.00 in paper copy, \$2.25 in microfiche. Report No. NSF/RA/G-74-012. 88 p. (1975). NSF GT-39556.

Descriptors: \*Water pollution, \*Air pollution, \*Erosion, \*Waste water treatment, \*Conferences, Domestic wastes, Ammonia, Pollutants, Lakes, Management, Administration, Political aspects, Salt tolerance, Vegetation effects, Weather modification, California, Nevada.  
Identifiers: \*Lake Tahoe (Nev - Calif).

Lake Tahoe Research Seminars are held quarterly to inform the public and interested researchers of current research projects and to develop lines of communication among those interested and involved in solving the problems of the Tahoe Basin. Topics discussed at the Research Seminar II (September 27, 1974) included: 'Preliminary Study of Experimental System for Ammonia Removal at South Lake Tahoe Advanced Wastewater Treatment Plant,' 'The Scientist and Decision-Making at Lake Tahoe,' 'Conifer Damage and Death Associated with the Use of Highway Deicing Salt in the Lake Tahoe Basin of California and Nevada,' 'Air Quality of the Lake Tahoe Basin,' 'Weather Modification in the Lake Tahoe Basin,' and 'Erodibility of Tahoe Soils.' (See W76-07794 thru W76-07799) (Sims - ISWS)  
W76-07793

PRELIMINARY STUDY OF EXPERIMENTAL SYSTEM FOR AMMONIA REMOVAL AT SOUTH LAKE TAHOE ADVANCED WASTEWATER TREATMENT PLANT,  
For primary bibliographic entry see Field 5D.  
W76-07794

THE SCIENTIST AND DECISION MAKING AT LAKE TAHOE,  
For primary bibliographic entry see Field 6B.  
W76-07795

CONIFER DAMAGE AND DEATH ASSOCIATED WITH THE USE OF HIGHWAY DEICING SALT IN THE LAKE TAHOE BASIN OF CALIFORNIA AND NEVADA,  
Forest Service (USDA), Berkeley, Calif. Pacific Southwest Forest and Range Experiment Station, Berkeley, Calif.  
For primary bibliographic entry see Field 5C.  
W76-07796

AIR QUALITY IN THE LAKE TAHOE BASIN,  
California Univ., Davis. Inst. of Ecology; and California Univ., Davis. Dept. of Physics.  
For primary bibliographic entry see Field 5A.  
W76-07797

WEATHER MODIFICATION IN THE LAKE TAHOE BASIN,  
For primary bibliographic entry see Field 3B.  
W76-07798

ERODIBILITY OF TAHOE SOILS,  
For primary bibliographic entry see Field 2J.  
W76-07799

PROPOSED KAIPAROWITS PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT.  
For primary bibliographic entry see Field 6G.  
W76-07800

NEBRASKA DISPOSAL WELLS REGULATIONS.  
Nebraska State Dept. of Environmental Control, Lincoln.  
In: 1973 BNA Environmental Rep. 836:0621-24 (Neb. Environ. Control Council Rules and Regs., 1972). 4 p.

Descriptors: \*Nebraska, \*Waste disposal wells, \*Waste water disposal, \*Underground waste disposal, \*Design criteria, Design data, Water resources, Waste disposal, Depth, Permits, Hydrologic aspects, Geologic formations, Monitoring, Injection wells, Injection, Equipment, Penalties(Legal), Groundwater, Subsurface waters, Legislation.

In order to protect groundwater and other subsurface resources from pollution, the State of Nebraska will henceforth require a permit be obtained before any person may erect, alter or operate any waste disposal well. The information required in the application for the permit will vary, depending on whether a construction permit is desired. Applications for a construction permit must contain the following: (1) information concerning general conditions, such as a map of the proposed site, a description of the depth of the wells, and a description of all mineral and water resources within the area of the system; (2) an evaluation of geologic and hydrologic conditions; (3) a summarization of the design and construction of the disposal well; (4) pertinent information concerning the disposal system; and (5) an analysis of the operation of the system, including any plans for monitoring critical factors. Before any approval will be given for an operating permit, the application must contain the design of the well within prescribed specifications, an evaluation of the injection zone, and a surface equipment design. To insure compliance with the above requirement, criminal and civil penalties are provided for violations. (Hoffman-Florida)  
W76-07801

REGISTRATION OF LIQUID WASTE HAULERS AND WASTE DISPOSAL TO LAND,  
In: 1975 BNA Environmental Rep. 721:0532-36 (Calif. Water Code). 7 p.

Descriptors: \*California, \*Liquid wastes, \*Transportation, \*Waste disposal, \*Permits, Legislation, Water quality control, Waste dumps, Waste water disposal, Administrative agencies, Sewage, Sewage disposal, Disposal, Drainage systems, Administrative decisions, Landfills.

In order to protect the quality of state waters, California requires that all liquid waste haulers be registered. Provisions pertaining to the application for, suspension or revocation of this registration are presented. Any liquid wastes carried by registered haulers may be disposed of only as authorized by statute or at an approved disposal site. Under no circumstances may the wastes be discharged into a community sewer system without the written approval of the operator of the system. Wastes may also not be discharged into drainage systems unless the waste discharge characteristics are in conformance with requirements prescribed by the regional water quality control board. To insure compliance with these discharged directives, all haulers must maintain legible records of each load hauled and must make them available for review by authorized state or regional board personnel. (Hoffman-Florida)  
W76-07802

MIXING OIL AND WATER: THE EFFECT OF PREVAILING WATER LAW DOCTRINES ON OIL SHALE DEVELOPMENT,  
Kutak, Rock, Cohen, Campbell, Garfinkle and Woodward, Omaha, Nebr.  
For primary bibliographic entry see Field 6E.  
W76-07806

ENVIRONMENTAL LAW: WHAT IS 'MAJOR' IN 'MAJOR FEDERAL ACTION', MINNESOTA PUBLIC INTEREST RESEARCH GROUP V. BUTZ, 498 F2D 1314 (8TH CIR. 1974).  
For primary bibliographic entry see Field 6E.  
W76-07809

STATE RESPONSIBILITY AND THE LAW OF INTERNATIONAL WATERCOURSES,  
Lewis Univ., Lockport, Ill. Coll. of Law.  
For primary bibliographic entry see Field 6E.  
W76-07811

OIL TANKER POLLUTION CONTROL: DESIGN CRITERIA VS EFFECTIVE LIABILITY ASSESSMENT,  
Department of the Treasury, Washington, D.C.  
P. A. Cummins, D. E. Logue, R. D. Tollison, and T. D. Willlett.  
Journal of Maritime Law and Commerce, Vol. 7, No. 1, p. 169-208 (1975). 32 p, 15 tab.

Descriptors: \*Ships, \*Design criteria, \*Oil spills, \*International waters, \*Oil industry, Oceans, Transportation, Waste water disposal, Water pollution sources, Water pollution abatement, Water pollution control, Fuels, Navigation, Law of the sea, United Nations, International law, Penalties(Legal), Oil pollution, United States.  
Identifiers: \*Oil tankers, \*Oil transportation, Marine environment, Maritime law, Shipping, Coast Guard, United Nations Conference on the Law of the Sea, Ship design.

The problem of damage to the marine environment from oil tanker spillage has drawn the attention of Congress and the U.S. Coast Guard, the International Marine Consultative Organization, and the United Nations Conference on the Law of the Sea. One important issue is whether there should be international minimum pollution control standards or whether each nation should impose its own standards, taking the risk that each nation's shipping costs will be as high as its standards are stringent. Another important issue involves the merits of standards based on ship design as opposed to standards of liability assessment for damages caused by oil shippers. Under the former proposal, oil shippers would not be held liable for oil spill damages if their ship complied with applicable design standards. The primary types of design criteria include the following: load-on-top, single-skin segregated ballast and double-skin segregated ballast. The authors discuss the characteristics of each type and analyze the relative costs and benefits using cost projections of total construction and annual separation along with estimated costs of spills and clean-up which might be likely to result from the alternative technologies. The effects of adopting these design criteria are compared with standards achievable by damage liability assessment. (Sloan-Florida)  
W76-07812

THE REGULATION OF DEEPWATER PORTS,  
K. A. Graham.  
Virginia Journal of International Law, Vol. 15, No. 4, p 927-57 (1975). 31 p.

Descriptors: Oil industry, \*Port authorities, \*Oil spills, Ships, Environmental effects, Economic efficiency, Economic justification, Ecology, Deep water, Shore protection, International Law, Structural engineering, Oil, \*Regulation, Oil pollution.  
Identifiers: \*Deepwater ports, \*Deepwater Port Act, Very large crude carriers, Ports, Licenses.

The United States' need for tremendous quantities of imported oil has led to the concurrent need for safe and economical facilities in which the very large crude carriers can discharge their cargo. This note examines and evaluates the advantages, disadvantages and side-effects of deepwater ports and of the new governing legislation, the Deepwater Port Act of 1974 (D.P.A.). Discussed first

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are the economic aspects of offshore oil ports. The author concludes that neither transshipment of refined petroleum products nor increased traffic in smaller tankers is an economically or environmentally acceptable alternative to deepwater ports. Also examined are the environmental effects of deepwater ports, the merits and shortcomings of the D.P.A. from the environmentalists' perspective, and the issue of federal and state control over licensing and regulation of deepwater ports in light of the D.P.A. The author suggests that the D.P.A. may have given the states too much control over the regulation of the deepwater ports.

W76-07813

**ENVIRONMENTAL ASPECTS OF DEEP SEA MINING,**  
Center for Law and Social Policy, Washington, D.C.  
For primary bibliographic entry see Field 6E.  
W76-07815

**CLEAN WATER FOR MID-AMERICA.**  
Federal Water Pollution Control Administration, Chicago, Ill. Great Lakes Region.  
Available from the National Technical Information Service, Springfield, Va. 22161, as PB-241 292, \$4.00 in paper copy, \$2.25 in microfiche. April, 1970. 30 p, 4 map, 12 photo, 4 draw, 1 chart.

Descriptors: \*Great Lakes, \*Mississippi River, \*Federal Water Pollution Control Act, \*Water pollution control, Water quality, Water pollution, Water Quality Act, Federal government, Great Lakes Region, Films, Publications, Water pollution sources, Pollution abatement, Water management(Applied).  
Identifiers: \*Federal Water Pollution Control Administration, \*Federal Clean Water Program, Non-degradation.

This booklet presents the programs that the Federal Water Pollution Control Administration (FWPCA) and the states comprising the Great Lakes Region have initiated to control the serious pollution problems facing the Great Lakes and the Upper Mississippi River through affirmative enforcement of the Federal Clean Water Program. Background information on the FWPCA is briefly presented describing the Administration's purpose and legal background, and its programs and operations especially in conjunction with supporting state, city, and industry programs. This profile specifically identifies particular pollution problems confronting each of the Great Lakes, and the Upper Mississippi River; furthermore, it introduces new problems, and indicates the specific solutions that the Federal Water Pollution Control Administration and the Great Basin States are implementing. Lists of Pollution Control Agencies and their locations, and lists of available films and Clean Water Publications are also contained within. (Hadoulias-Florida)  
W76-07821

**THE ROLE OF NORTH CAROLINA IN REGULATING OFFSHORE PETROLEUM DEVELOPMENT,**  
North Carolina Univ. at Chapel Hill. School of Law.  
For primary bibliographic entry see Field 6E.  
W76-07822

**LEGAL CONSIDERATIONS FOR THE CONSTRUCTION AND OPERATION OF A DEEP-WATER OIL TERMINAL IN THE DELAWARE BAY,**  
Delaware Univ., Newark. Coll. of Marine Studies.  
For primary bibliographic entry see Field 6E.  
W76-07823

**MAJOR ISSUES OF THE LAW OF THE SEA,**  
New Hampshire Univ., Durham.  
For primary bibliographic entry see Field 6E.

W76-07827

**MARINE POLLUTION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
For primary bibliographic entry see Field 6E.  
W76-07836

**CONCLUSION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
For primary bibliographic entry see Field 6E.  
W76-07842

**PREPARATION OF WATER QUALITY MANAGEMENT PLANS.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 230, p 55343-49, November 28, 1975. 7 p.

Descriptors: \*Federal Water Pollution Control Act, \*Sewage effluents, \*Pollution abatement, \*Industrial wastes, \*Domestic wastes, Municipal wastes, Water pollution sources, Water pollution effects, Water pollution control, Water pollution treatment, Water quality control, Administrative decisions.

Identifiers: Administrative regulations, FWPCA Amendments of 1972, Non-point sources(Pollution).

Pursuant to the Federal Water Pollution Control Act Amendments of 1972 the Environmental Protection Agency has promulgated regulations describing the requirements for preparation of state water quality management plans. The objective of the plans is to achieve the 1983 national water quality goal. The plans must be submitted by the states by November 1, 1978. Each plan must include: planning boundaries; water quality assessment and segment classifications; inventories and projections of municipal and industrial pollutant sources; non-point source assessments; applicable water quality standards; total maximum daily loads allowable of relevant pollutants; point source load allocations for each water quality segment for the next five plan years; municipal waste treatment system needs in five year increments for a twenty year period; industrial waste system needs; non-point source control needs; residual waste control needs; urban and industrial stormwater needs; target abatement dates; and statements of environmental, social and economic impact. (Comer-Florida)  
W76-07843

**ORE MINING AND DRESSING POINT SOURCES CATEGORY, INTERIM FINAL RULES.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 215, p 51722-37 November 6, 1975. 16p, 17 tab.

Descriptors: \*Mine wastes, \*Waste disposal, \*Administrative agencies, \*Waste water treatment, \*Pollution abatement, Legislation, Water pollution, Conservation, Water quality, Regulation, Pollutants, Impaired water quality, Water pollution treatment, Waste water(Pollution), Legal aspects, Water quality standards, Water purification, Standards, Classification.

Identifiers: Effluent limitations, Point sources(Pollution), Administrative regulations, Demineralization.

The Environmental Protection Agency has set forth interim final rules for effluent limitations and guidelines for the Ore Mining and Dressing point source category pursuant to the Federal Water Pollution Control Act. The regulation mentions the legal authority for the regulations applicable to standards of performance for new and existing

point sources. Also discussed are the following: (1) categorization of the point sources; (2) waste characteristics; (3) the origin of waste water pollutants evident in the ore mining and dressing sector; (4) waste water treatment and control technologies for each subcategory; (5) cost estimates for control of waste water pollutants; (6) energy requirements and non-quality environmental impacts; and (7) an analysis of the economic impact of compliance with the regulation. (Griffith-Florida)  
W76-07844

**ORE MINING AND DRESSING POINT SOURCE CATEGORY.**

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 215, p 51738-47, November 6, 1975. 12p, 32 tab.

Descriptors: \*Classification, \*Mine wastes, \*Waste water treatment, \*Pollution abatement, \*Water pollution sources, Water pollution, Water pollution control, Water pollution treatment, Water quality, Control, Regulation, Pollutants, Administrative decisions, Water treatment, Mine wastes, Waste water(Pollution), Water purification, Legal aspects, Legislation, Conservation, Water quality standards, Standards, Waste disposal.

Identifiers: Effluent limitations, Point sources(Pollution), Demineralization, Administrative proposals.

The Environmental Protection Agency has proposed various effluent guidelines and standards of performance, which will amend the Ore Mining Point Source Category pursuant to sections 306(b) and 307(b) and (c) of the Federal Water Pollution Control Act. The proposal places time restrictions on the implementation of effluent limitations of both existing and new point sources. These limitations focus on the implementation of the greatest degree of effluent reduction which the Administrator determines to be available through demonstrated control technology, processes, operating methods, or other alternatives. The proposed regulation sets forth pretreatment standards for pollutants introduced into publicly owned treatment plants, rather than to discharges of pollutants into navigable waters. The standards of performance, pretreatment standards and effluent limitation guidelines are individually listed for: (1) iron ore; (2) base and precious metals; (3) bauxite; (4) ferroalloy ores; (5) uranium, radium and vanadium ores; (6) mercury ore; and (7) titanium ore. (Griffith-Florida)  
W76-07845

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION CONCENTRATED ANIMAL FEEDING OPERATIONS.**

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 225, p 54182-86, November 20, 1975. 5p.

Descriptors: \*Administrative decisions, \*Feed lots, \*Permits, \*Waste disposal, \*Navigable waters, Administrative agencies, Regulation, Pollutants, Legislation, Legal aspects, Water quality, Effluents, Waste water(Pollution), Water quality control, Wastes, Conservation, Farm wastes, Water pollution, Animal wastes(Wildlife).  
Identifiers: Administrative regulations, National Pollutant Discharge Elimination System.

In response to its concern over the discharge of pollutants from various point sources, the Environmental Protection Agency (EPA) has proposed regulations for concentrated animal feeding operations. The proposed regulations delineate the scope of the National Pollutant Discharge Elimination System (NPDES) permit program. The proposed regulations define

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'concentrated animal feeding operation' in terms of three criteria. If any one of these three criteria apply to a particular animal feeding operation, the facility will be required to apply for and obtain a permit. However, no permit is required by the owner if: (1) there is no discharge of a pollutant; (2) the discharge of a pollutant does not reach navigable waters; or (3) the only time a discharge of pollutants into navigable waters occurs is during a 25 year, 24 hour rainfall event. The regulation also permits a case by case determination that a particular animal feeding operation is a point source subject to regulation. Comments upon all aspects of the proposed regulation are solicited by the EPA. (Griffith-Florida)  
W76-07846

**COAL MINING POINT SOURCE CATEGORY: APPLICATION OF EFFLUENT LIMITATIONS GUIDELINES FOR EXISTING SOURCES TO PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 202, p 48839-40, October 17, 1975. 2p.

Descriptors: \*Federal Water Pollution Control Act, \*Waste treatment, \*Waste treatment, \*Coal mine wastes, \*Treatment facilities, Coal mines, Mine wastes, Water pollution sources, Industrial wastes, Environmental effects, Cost-benefit ratio, Effluents, Industrial effluents, Discharge(Water), Industrial water, Administrative agencies, Decision making, Policy, Pollutants, Compatibility.  
Identifiers: \*Point sources(Pollution), Administrative regulations, Effluent limitations.

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency has proposed to amend the coal mining point source category regarding the application of effluent limitations guidelines for existing sources to pretreatment standards for incompatible pollutants. The proposal will establish for each subcategory therein the extent of application of effluent limitations guidelines to existing sources which discharge to publicly owned treatment works. The agency developed its proposal after consideration of the following factors: (1) the pollutants present in waste waters resulting from the mining and preparation of coal, the characteristics of these pollutants, and the degree of pollutant reduction attainable; (2) the anticipated effects on other aspects of the environment of the treatment technologies available; and (3) the estimated cost and energy consumption implications of those technologies and their potential effects on cost and production of coal. The agency now believes that the effluent limitations guidelines should not be applied to pretreatment standards for the introduction of incompatible pollutants into municipal systems by existing sources in the coal preparation, coal storage, refuse storage, and coal preparation ancillary area, nor in the acid or ferruginous mine drainage and the alkaline mine drainage subcategories. The operator of a publicly owned treatment works is cautioned that some of the constituents of the waste waters may interfere with certain treatment works or may pass through such works inadequately treated. (Reinders-Florida)  
W76-07847

**COAL MINING POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 202, p. 48830-38, October 17, 1975. 9 p, 6 tab.

Descriptors: \*Effluents, \*Coal mine wastes, \*Acidic mine water, \*Chemical wastes, \*Classification, Industrial wastes, Waste water treatment, Waste water disposal, Waste water(Pollution), Environmental control, Solid

wastes, Aeration, Filtration, Administrative agencies, Standards, Administrative decisions.  
Identifiers: Effluent limitations, \*FWPCA amendments of 1972, Administration regulations.

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency has promulgated interim final rules establishing a coal mining point source regulation category. The agency also proposes standards for existing source pretreatment within the category. Four coal mining point source subcategories, coal preparation plants, ancillary areas, acid or ferruginous mine discharge, and alkaline mine drainage, are identified. For existing point sources within these subcategories the following effluent limitations are proposed: for coal preparation plants, no process water discharge; for all other subcategories, daily and average daily values for thirty consecutive day periods expressed in milligrams per unit for iron, aluminum, manganese, nickel, zinc and TSS. Ranges for pH levels are proposed. The proposed standards express maximum amounts allowable using best available technology. Other pollutants were considered before the proposal publication but the level observed does not warrant consideration of limitations. (Comer-Florida)  
W76-07848

**MINERAL MINING AND PROCESSING POINT SOURCE CATEGORY INTERIM FINAL RULEMAKING.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 201, p 48652-64, October 16, 1975, 13p, 1 tab.

Descriptors: \*Effluents, \*Brine disposal, \*Federal Water Pollution Control Act, \*Mineral industry, \*Waste water treatment, Waste water disposal, Environmental control, Acid mine water, Mine wastes, Mine drainage, Water pollution sources, Legislation, Classification, Standards, Waste disposal wells.  
Identifiers: \*Effluent limitations, FWPCA Amendments of 1972, Administrative regulations.

Pursuant to the Federal Water Pollution Control Act, the Environmental Protection Agency has promulgated interim final rules establishing a mineral mining and processing point source category and regulating same. The regulation treats 38 distinct subcategories of mineral mining and processing. Treatment technologies for 21 of the subcategories are undefined pending economic impact analysis of the draft recommendations. For the gypsum, asphaltic minerals, asbestos and wollastonite, borax, potash, sodium sulfate, Frasch sulfate, magnesite, diatomite, jade, novaculite and graphite subcategories, only the volume of water resulting from precipitation that exceeds the maximum safe surge capacity of an impoundment can be discharged. The safe surge level must be greater than normal operations by the rain representing the 10 year 24 hour rainfall event. No discharge of waste water pollutants may be made otherwise. Barite, bentonite, fluorspar and tripoli subcategory plants normally use no water for processing. For plants which use water, standards are still under study. Plants extracting salines from brine lakes normally discharge the bitterns into the intake body of water. Under the interim rules, no added constituents may be discharged into navigable waters. (Comer-Florida)  
W76-07849

**GRAIN MILLS POINT SOURCE CATEGORY: PROPOSED PRETREATMENT STANDARDS FOR NEW SOURCES.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 165, p 37052-54, August 25, 1975. 2 p.

Descriptors: \*Federal Water Pollution Control Act, \*Waste treatment, \*Waste water disposal,

\*Mills, \*Industrial water, Waste water treatment, Water law, Administrative agencies, Planning, Decision making, Water policy, Water control, Technology, Water quality, Industrial wastes, Water policy, Pollution abatement, Solid wastes, Disposal, Suspended solids, Water pollution sources.  
Identifiers: \*FWPCA Amendments of 1972, Administrative regulations, Point sources(Pollution).

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) has proposed amendments to the pretreatment standards for new sources in the Corn Wet Milling Subcategory. On May 5, 1975 the Eighth Circuit Court of Appeals remanded these pretreatment standards to the EPA, directing it to review paragraph (d) of section 128.131, as it applies to the corn wet milling industry through section 406.16, and to amend the regulation to define in a reasonably specific manner what it considers to be an excessive discharge to a publicly owned treatment works over relatively short periods of time. In response to the remand, the EPA has developed a formula to quantify excessive loads from new corn wet mills to publicly owned treatment works. The EPA solicited and examined a broad range of data and gave full consideration to such factors as waste characteristics, origin of waste water pollutants, and treatment and control technology. The proposed formula standard is explained in detail. (Reinders-Florida)  
W76-07850

**INK FORMULATING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS,**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 145, p. 31726-28, July 28, 1975. 3 p.

Descriptors: \*Water pollution abatement, \*Standard, \*Federal Water Pollution Control Act, \*Industrial wastes, Industrial water, Solvents, Effluents, Economic impact, Discharge(Water), Chemical wastes, Waste identification, Water pollution sources, Water treatment, Oily water, Classification, Data collections.  
Identifiers: \*FWPCA Amendments of 1972, effluent limitations.

The Environmental Protection Agency, in formulating effluent limitations guideline for existing sources and standards of performance and pretreatment standards within the oil-base ink subcategory and the water-base ink subcategory of the ink formulating category of point sources, drew a distinction between plants using a solvent wash system and caustic wash system. The agency needs further data on the process using a caustic wash, and will promulgate standards at a later date. The agency has all the data necessary for the process using a solvent wash and has found that all of the oil-base solvent wash ink plants meet current standards. Because all oil-base solvent wash ink plants meet the requirements, there is minimal economic impact. (Edenfield-Florida)  
W76-07851

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 137, p. 29848-50, July 16, 1975. 3p.

Descriptors: \*Federal Water Pollution Control Act, \*Administrative agencies, \*Discharge frequency, \*Discharge measurement, \*Sewage effluents, Industrial wastes, Water pollution sources, Water quality, Municipal water, Municipal wastes, Sewage, Water quality control, Legislation, Classification.  
Identifiers: \*Administrative regulations, \*Effluent limitations.

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Pursuant to authority of the Federal Water Pollution Control Act, the Environmental Protection Agency has promulgated amendments to the National Pollutant Discharge Elimination System regulations. One amendment requires municipal type facility applicants to file Standard Form A if the facility meets any of the following requirements: serves more than 10,000 people; discharges more than five million gallons on any day; receives industrial waste which totals more than 50,000 gallons on any day or more than 5% of facility volume in any day; or which receives wastes containing toxic pollutants or which, in combination with other substances, may adversely affect facility discharges. Another amendment requires no maximum daily quantitative limitation specification on publicly owned treatment works permits. A third amendment requires permit effluent limitation expressions to be in gross terms unless the intake water body and discharge water body are the same and net term expression is required elsewhere, or intake water contains pollutants not removed by required treatment. The intake and discharge pollutants may not undergo chemical or biological change. To insure compliance with the above requirements, all permits issued pursuant to these regulations must require appropriate monitoring. (Comer-Florida)

W76-07852

**NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY, EFFLUENT LIMITATIONS AND GUIDELINES.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 111, p. 24539-40, June 9, 1975. 2p.

Descriptors: \*Federal Water Pollution Control Act, \*Water pollution sources, \*Industrial effluents, Discharge(Water), \*Industrial water, \*Impoundments, Pollution abatement, Effluents, Aluminum, Industrial wastes, Industrial plants, Water pollution, Water policy, Waste water(Pollution), Water law, Water management(Applied), Rainfall disposition, Water quality, Pollutants, Decision making, Administrative decisions, Administrative agencies.

Identifiers: \*Effluent limitations, \*Point sources(Pollution), Administrative regulations.

The Environmental Protection Agency (EPA) has invited proposals regarding suggested Amendments to Subparts A and C of 40 CFR Part 421—Nonferrous Metals Manufacturing Point Source Category. In Part 421 the EPA established for the bauxite refining subcategory an effluent limitation of 'no discharge of process waste water pollutants to navigable waters'. The regulations do allow, however, for the discharge of excess rainfall that falls within an impoundment. Precise definition of the term 'within the impoundment' is therefore important. The effect of the proposed definition is to give credit for all rainfall within the defined extended drainage area, in the calculation of the volume of water which may be discharged from the impoundment. An amendment to Subpart C is also proposed to resolve an ambiguity in the regulation by making it clear that Subpart C will not apply at this time to wastes in a less significant waste stream including waste from furnace wet scrubbers. Interested persons are invited to submit written comments. (Reinders-Florida)

W76-07853

**NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY,**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 200, p. 48348, October 15, 1975. 1 p.

Descriptors: \*Federal Water Pollution Control Act, \*Pollution abatement, Discharge(Water), \*Effluents, Aluminum, Industrial wastes, Industrial plants, Water pollution, Water pollution

sources, Waste water(Pollution), Water law, Water management(Applied), Rainfall disposition, Water quality, Pollutants, Inpoundments, Classification.

Identifiers: Effluent limitations, \*Point sources(Pollution), Administrative regulations.

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency (EPA) is establishing final amendments to the effluent limitations and guidelines for existing sources and standards of performance and pretreatment standards for new sources in the nonferrous metals manufacturing category of point sources. These amendments specifically pertain to the bauxite refining subcategory(Subpart A) and the secondary aluminum smelting subcategory(Subpart C). Most operators of bauxite refining plants collect the plants rainfall runoff in mud ponds or some other storage reservoir. By suitable water management techniques, it is the opinion of the EPA that there is no need for the relatively uncontaminated stormwater to contact and mix with process waste water. This final amendment limits discharges of such process waste water but does not limit the discharge of rainfall runoff. To aid in the implementation of these directives, specialized definitions of the terms 'within the impoundment' and 'pond water surface area' are presented. The final amendments also provide that the provisions of the secondary aluminum smelting subcategory will apply to discharges of fume-scrubbing wastewaters where aluminum fluoride or chlorine is used in the magnesium removal process. The provisions will also apply to wet residue milling and metal cooling wastewaters resulting from the use of aluminum scrap needed to produce metallic aluminum alloys. (Reinders-Florida)

W76-07854

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING.**  
Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol. 40, No. 204, p. 49222-35, October 21, 1975. 14 p, 7 tab.

Descriptors: \*Federal Water Pollution Control Act, \*Classification, \*Effluents, \*Chemical wastes, \*Biochemical oxygen demand, Acidic water, Organic wastes, Environmental control, Industrial wastes, Waste water treatment, Waste disposal, Environmental sanitation, Waste water(Pollution), Administrative agencies, Standards.

Identifiers: \*Effluent limitations, \*FWPCA Amendments of 1972, Administrative regulations.

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency has promulgated interim final rules establishing effluent limitations for large sources in the canned and preserved fruits and vegetables processing industry point source category. The Agency also proposes standards for maximum sources in the category. Large sources process total raw materials totaling more than 10,000 tons per year. Three sub-categories exist: canned and preserved fruits, canned and preserved vegetables, and canned and miscellaneous specialties. Significant pollutant parameters identified in all sub-categories include biochemical oxygen demand (BOD 5), total suspended non-filterable solids (TSS), fecal coliforms and pH. Oil and grease are also significant in specialty processing. Effluent limitations are expressed in both metric and English units for identified fruits, vegetables, or specialties within each sub-category. Proposed amendments include standards based on best available technology economically achievable for existing sources. The interim final rule applies best technology currently available. (Comer-Florida)

W76-07855

**IRON AND STEEL MANUFACTURING POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.**

Environmental Protection Agency, Washington, D.C.  
Federal Register, Vol 40, No. 163, p. 36708-44, August 21, 1975. 37p, 104 tab.

Descriptors: \*Federal Water Pollution Control Act, Effluents, Brine disposal, \*Acidic water, \*Industrial wastes, Waste water treatment, Environmental control, Waste identifications, Waste water disposal, Water pollution sources, Waste water(Pollution), Sludge, Sludge treatment.

Identifiers: \*Effluent limitations, \*FWPCA Amendments of 1972, Administrative regulations.

Pursuant to the authority of the Federal Water Pollution Control Act, the Environmental Protection Agency has proposed effluent limitations and guidelines for existing sources in the iron and steel manufacturing category. Tentative proposals are also presented for new category sources. The proposals will add fourteen new sub-categories based upon processing method. Effluent limits are proposed on the basis of application of the best practicable control technology currently available and on the basis of the best available technology economically achievable. Standards are separately stated for new source performance and for new source pretreatment. The sub-categories identified are: hot forming, section; hot forming, flat; pipes and tubes; pickling, sulfuric acid, batch; pickling, hydrochloric acid, batch and continuous; cold rolling; hot coatings, galvanizing; hot coatings, terne; miscellaneous runoff, storage piles, casting and slaggering; cooling water blowdown, utility blowdown; maintenance department wastes; and central treatment. Each subcategory is given separate standards based upon water use and pollutant result. Proposed maximum effluent limitations are expressed in metric and English units. (Comer-Florida)

W76-07856

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.**  
Environmental Protection Agency, Washington, D.C.

Federal Register, Vol. 40, No. 204, p. 49237-65, October 21, 1975. 29p, 24 tab.

Descriptors: \*Federal Water Pollution Control Act, \*Effluents, \*Chemical wastes, \*Biochemical oxygen demand, \*Acidic water, Waste disposal, Waste water treatment, Environmental sanitation, Industrial wastes, Waste water(Pollution), Organic wastes, Environmental Control, Hydrogen ion concentration.

Identifiers: \*Effluent limitations, \*FWPCA Amendments of 1972, Administrative regulations.

Pursuant to the Federal Water Pollution Control Act, the Environmental Protection Agency proposes regulations establishing effluent limitations for the canned and preserved fruits and vegetables processing industry category. These proposals will affect effluent limitations for existing sources, pretreatment standards for existing sources, and performance and pretreatment standards for new sources. The proposals are particularly concerned with limitations for medium sized plants, which are defined as plants processing between 2,000 and 10,000 tons of raw materials per year. Each subcategory, canned and preserved fruits, canned and preserved vegetables, canned and miscellaneous specialties, is further divided into identifiable fruits, vegetables and specialties for effluent limitation establishment. Each of these subcategories must meet specified limitations pertaining to the following factors: biochemical oxygen demand, total suspended nonfilterable solids, fecal coliforms, hydrogen ion concentration, and oil and grease concentrations. Guidelines pertaining to these limitations are expressed both

## Field 5—WATER QUALITY MANAGEMENT AND PROTECTION

### Group 5G—Water Quality Control

in terms of best practicable control technology currently available and best available technology economically achievable. Pretreatment standards are separately expressed as are new source standards. (Comer-Florida)  
W76-07857

**DEVELOPMENT OF NEW REGULATIONS BY THE CORPS OF ENGINEERS, IMPLEMENTING SECTION 404 OF THE FEDERAL WATER POLLUTION CONTROL ACT CONCERNING PERMITS FOR DISPOSAL OF DREDGE OR FILL MATERIAL.**

For primary bibliographic entry see Field 6E.  
W76-07862

**TO AMEND THE LAND AND WATER CONSERVATION FUND ACT OF 1965 AND TO AMEND THE HISTORIC PRESERVATION ACT OF 1966.**  
For primary bibliographic entry see Field 6E.  
W76-07864

**UNITED STATES V. BEATTY, INC. (GOVERNMENT RIGHT TO RECOVER EXPENSES FOR CLEANING UP OIL SPILLS),**  
For primary bibliographic entry see Field 6E.  
W76-07870

**UNITED STATES V. EUREKA PIPELINE CO. (PENALTY DETERMINATION UNDER FEDERAL WATER POLLUTION CONTROL ACT).**  
For primary bibliographic entry see Field 6E.  
W76-07871

**UNITED STATES V. GENERAL MOTORS CORP. (CRIMINAL AND CIVIL PENALTIES FOR OIL DISCHARGE INTO NAVIGABLE WATERS).**  
For primary bibliographic entry see Field 6E.  
W76-07872

**STATE V. CALLAWAY (FEDERAL WATER POLLUTION CONTROL ACT).**  
For primary bibliographic entry see Field 6E.  
W76-07873

**BOTSCHE V LEIGH LAND COMPANY (ODORS FROM FEEDLOT LAGOON AS NUISANCE).**  
For primary bibliographic entry see Field 6E.  
W76-07876

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V METZGER (MAXIMUM LEVEL OF GROUND WATER AT LEAST FOUR FEET BENEATH EXCAVATION FOR SEWER).**  
For primary bibliographic entry see Field 6E.  
W76-07881

**COMMONWEALTH DEPT OF ENVIRONMENTAL RESOURCES V CITY OF LEBANON (IF FLUORIDATION NOT A PREREQUISITE FOR ISSUANCE OF WATER SUPPLY PERMIT, THEN CANNOT BE FOR MODIFICATION THEREOF).**  
For primary bibliographic entry see Field 6E.  
W76-07883

**LOVELADIES PROPERTY OWNERS ASS'N V. RAAB (FILING OF WETLANDS MAP PRE-REQUISITE TO REGULATION OF LANDS UNDER WETLANDS ACT OF 1970).**  
For primary bibliographic entry see Field 6E.  
W76-07884

**IN RE WILDLIFE WONDERLAND, INC. (VERMONT ENVIRONMENTAL BOARD FINDINGS OF POSSIBLE GAME FARM WATER POLLUTION ENOUGH TO DENY PERMIT).**

For primary bibliographic entry see Field 6E.  
W76-07886

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V. FLEETWOOD BOROUGH AUTHORITY (CRIMINAL ASSESSMENT AGAINST BOROUGH FOR VIOLATION OF CLEAN STREAMS LAW).**

For primary bibliographic entry see Field 6E.  
W76-07887

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V MONONGAHELA AND OHIO DREDGING COMPANY (INSURANCE OF CEASE AND DESIST ORDER TO DREDGING COMPANY WITHOUT A HEARING NOT A DENIAL OF DUE PROCESS).**  
For primary bibliographic entry see Field 6E.  
W76-07888

**CITY OF CONCORD V WATER SUPPLY AND POLLUTION CONTROL COMMISSION (ORDER TO COVER OPEN HIGH SERVICE DISTRIBUTION RESERVOIR NOT UNREASONABLE).**

For primary bibliographic entry see Field 6E.  
W76-07889

**COMMONWEALTH DEPT. OF ENVIRONMENTAL RESOURCES V MILLS SERVICE, INC. (ABUSE OF DISCRETION BY ENVIRONMENTAL HEARING BD IN DETERMINATION OF POLLUTING PENALTY).**

For primary bibliographic entry see Field 6E.  
W76-07890

**LEHAN V. COMMONWEALTH DEPT. OF TRANSPORTATION, (DISCHARGE OF WASTE MATERIALS ONTO LAND OWNER'S PROPERTY NOT A DEFACTO TAKING BY STATE).**

For primary bibliographic entry see Field 6E.  
W76-07891

**AMERICAN MEAT INSTITUTE V. EPA 'EFFLUENT LIMITATIONS' ON SLAUGHTERHOUSES UNDER THE FEDERAL WATER POLLUTION CONTROL ACT.**

For primary bibliographic entry see Field 6E.  
W76-07907

**NATIONAL RESOURCES DEFENSE COUNCIL V. CALLAWAY (FEDERAL WATER POLLUTION CONTROL ACT).**

For primary bibliographic entry see Field 6E.  
W76-07908

**COMMONWEALTH V. WASHINGTON TOWNSHIP (PA. CLEAN STREAMS LAW).**

For primary bibliographic entry see Field 6E.  
W76-07910

**MOBIL OIL CORP. V. TOWN OF HUNTINGTON (CONSTITUTIONALITY OF OIL SPILLAGE ORDINANCE).**

For primary bibliographic entry see Field 6E.  
W76-07915

**STATE DEPARTMENT OF ENVIRONMENTAL RESOURCES V METZGER (JUSTIFICATION OF SEWER REGULATIONS: MERE POSSIBILITY OF WATER POLLUTION).**

For primary bibliographic entry see Field 6E.  
W76-07919

**LEHAN V STATE DEPARTMENT OF TRANSPORTATION (SEWAGE POLLUTION OF LANDOWNER'S WELL NOT A TAKING UNDER EMINENT DOMAIN CODE),**  
For primary bibliographic entry see Field 6E.  
W76-07921

**STATE DEPT. OF ENVIRONMENTAL PROTECTION V. JERSEY CENTRAL PWR AND LIGHT CO. (NO LIABILITY FOR DISCHARGE OF UNHEATED WATER INTO STREAM BECAUSE SUCH WATER NOT PROXIMATE CAUSE OF DEATH OF FISH),**  
For primary bibliographic entry see Field 6E.  
W76-07923

**POLLUTION: CONCEPT AND DEFINITION,**  
Australian National Univ., Canberra. Dept. of Forestry.  
V. S. Russell.  
Biol Conserv. 6(3), p 157-161, 1974.

Descriptors: \*Pollution, Water quality, Water pollution, Air pollution, Soil pollution, Pollutant identification, \*Classification, Waste identification.

The term 'pollution' is widely used and widely misunderstood. Definitions of the term are examined and alternatives suggested. Certain natural phenomena causing deterioration in the quality of water, air, or soil may be similar in their effects to some of man's activities. It is suggested that the term 'pollution' be restricted to certain human activities. Some of the implications of man's activities in the biosphere are examined.--Copyright 1974, Biological Abstracts, Inc.  
W76-07955

**SERUM CONSTITUENTS OF THE MALAYSIAN PRAWNS (MACROBRACHIUM ROSENBERGI) AND PINK SHRIMP (PENAEUS MARGINATUS),**  
Hawaii Inst. of Marine Biology, Honolulu.  
For primary bibliographic entry see Field 5C.  
W76-07966

**BLOOD SUCKING DIPTERA OF THE VICINITY OF ABAKAN (KHAKASS AUTONOMOUS OBLAST OF KRASNOYARSK KRAI): I. THE SPECIFIC COMPOSITION AND BREEDING PLACES OF CULICIDAE, (IN RUSSIAN),**  
Institute of Medical Parasitology and Tropical Medicine, Moscow (USSR).  
N. Ya. Markovich, and A. M. Proskuryakova.  
Med Parazitol Parazit Bolezni 43(5), p 551-557, 1974.

Descriptors: \*Diptera, \*Mosquitoes, \*Insect control, Water pollution control.  
Identifiers: Abakan, Aedes-Behningi, Aedes-Caspia-Caspia, Aedes-Caspia, Dorsalis, Aedes-Cinerus, Aedes-Maculipennismesseae, Aedes-Strannheus, Aedes-Vexans-Nipponii, Culex-Modestus, Culex-Pipiens-Pipiens, Culicidae, Khakass, Krai, Oblast, \*USSR(Krasnoyarsk region).

In the zone of insular steppes of the southern Krasnoyarsk region (USSR) mosquitoes represented by 26 spp. and subspecies were most prevalent among bloodsucking Diptera (Clusiidae). The dominant mosquitoes were of the genus Aedes, among them A. vexans nipponi; in the season of 1970, with high flooding, there were also A. cinereus and A. behningi. In the 2nd half of the summer in some areas of the territory there were numerous A. caspius dorsalis, A. c. caspius and A. strannheus. Culex modestus and C. pipiens pipiens, frequently occurring in preimaginal stages in water bodies, were found only occasionally among mosquitoes attacking man. The main breeding places of mosquitoes were in the floodlands of the Enisey and the Abakan which were

## WATER RESOURCES PLANNING—Field 6

### Techniques Of Planning—Group 6A

hyperthermic most of the season. *A. maculipennis messeae* developed mainly in different streams and old river beds in the vicinity of the town.—Copyright 1975, Biological Abstracts, Inc.  
W76-07988

#### RUBBER ROOF PROTECTS WATER FROM POLLUTANTS.

For primary bibliographic entry see Field 5F.  
W76-08003

#### THE PRESENT CONDITION OF WATER POLLUTION AND THE FUTURE PROBLEMS (SUISHITSU ODAKU NO GENJO TO KONGO NO MONDAITEN),

Japan Environmental Agency, Tokyo.  
For primary bibliographic entry see Field 5A.  
W76-08007

#### STORM DRAINAGE 'FILTERED' BEFORE DISCHARGE,

B. Haro.  
Public Works, Vol. 104, No. 9, p 124-125, September, 1973. 2 fig.

Descriptors: \*Storm runoff, \*Filtration, Streams, Watersheds(Basins), Urban runoff, Pipes, Trenches, Drainage systems, Drainage engineering, Drainage programs, Washington, Water pollution control.

Identifiers: Bellevue(Wash.).

The growing demand for wider streets, parking areas, and other impervious surfaces has raised the question of preservation of natural streams and drainage basins in Bellevue, Washington. With this in mind, the Department of Public Works began investigation of methods to control its urban storm runoff problem. As an experimental approach during the design of a new municipal parking lot, the city decided to install what was nicknamed an 'environmental filter system'. The purpose of the system is to delay the runoff water in reaching the storm drainage system, reduce the amount of water entering the drainage system, and filter the runoff water. The filter system consists of two primary cross sections; a trench five feet wide and another two feet wide. In both cases, their depth is five feet, determined by the depth to the groundwater table. The section five feet wide receives runoff water from both sides, while the narrower section gets its water from only one side. At the catch basin where the perforated pipe meets the existing storm drainage system, the incoming invert is six inches below the outgoing invert. This forces the perforated pipe to remain partly full after the storm has passed and allows the system to redistribute the stored water back through the trench for maximum seepage into the adjacent soil. (Sandoski-FIRL)  
W76-08032

#### A MULTI-OBJECTIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT USING GOAL PROGRAMMING,

McGill University, Montreal, Canada, Department of Civil Engineering and Applied Mechanics.

For primary bibliographic entry see Field 6G.  
W76-08072

#### STORM DRAINAGE AND URBAN REGION FLOOD CONTROL PLANNING,

Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08086

#### EQUITY CONSIDERATIONS IN CONTROLLING NONPOINT POLLUTION FROM AGRICULTURAL SOURCES,

Purdue Univ., Lafayette, Ind. Dept. of Agricultural Economics.

W. L. Miller, and J. H. Gill.

Water Resources Bulletin, Vol. 12, No. 2, p 253-261, April 1976. 3 tab, 12 ref.

Descriptors: \*Water pollution control, \*Agriculture, \*Linear programming, \*Farms, Size, \*Economic impact, \*Indiana, Constraints, Research, Mathematical models, Systems analysis, Water pollution sources.

Identifiers: \*Nonpoint pollution sources, Net revenue maximization, Topographic areas, Soil loss standard, Tax subsidies.

The objectives of the research reported in this paper are: (1) to compare the relative economic impact on large and small farms of applying a statewide soil loss standard to achieve specified levels of pollution control as measured in tons of soil loss per acre per year; (2) to compare the relative impact between two different topographic areas in Indiana with respect to the statewide standard; and (3) to compare the relative economic impact between large and small farms and between different topographic areas resulting from application of taxes-subsidies on soil loss. Accomplishing these objectives will illuminate some of the equity consequences of application of two quite different approaches to controlling nonpoint pollution from agricultural sources. A linear programming model has been used to analyze the objectives. The model includes an objective function to maximize net revenue to the farm firm by selecting among a wide array of management practices applied on several different soil groups. It is concluded that the imposition of standard state soil loss rules has an unequal impact on the income of different size firms located in different topographic regions. (Bell-Cornell)  
W76-08094

#### PUBLIC HEALTH ASPECT OF TROPICAL WATER RESOURCES DEVELOPMENT,

Nigeria Univ., Nsukka. Dept. of Civil Engineering, N. Egbunwe.

Water Resources Bulletin, Vol. 12, No. 2, p 393-398, April 1976. 27 ref.

Descriptors: \*Water resources development, \*Tropic, \*Public health, \*Diseases, Projects, Africa, Tennessee Valley Authority, \*Water quality control.

Identifiers: \*Nigeria(W Africa), \*Developing countries, \*Disease control.

The Governments of Nigeria have planned to build 395 dams in the next five years. Such water resources development may increase the incidence of Schistosomiasis, Malaria, Onchocerciasis, and Trypanosomiasis. Adequate measures need to be taken to minimize adverse effects of the projects on the public health. The proper preparation of reservoir sites before filling, the fluctuation of water levels and vegetation clearance that have been used successfully for mosquito control by the Tennessee Valley Authority should be tried by the Nigerian Authorities. The adverse effects on the public health may be prevented by designing the multiple-purpose projects to minimize the transmission of diseases and by providing in the budget for any water development project a fund to meet both recurrent costs and unforeseen problems concerned with the public health of the communities living around the project areas. (Bell-Cornell)  
W76-08096

## 6. WATER RESOURCES PLANNING

### 6A. Techniques Of Planning

#### OPTIONS FOR COST SHARING: COST SHARING ISSUES-DIMENSIONS, CURRENT SITUATION AND OPTIONS.

Water Resources Council, Washington, D.C.

For primary bibliographic entry see Field 6C.  
W76-08035

#### A MULTI-OBJECTIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT USING GOAL PROGRAMMING,

McGill University, Montreal, Canada, Department of Civil Engineering and Applied Mechanics. For primary bibliographic entry see Field 6G.  
W76-08072

#### SEQUENCING TECHNIQUES FOR PROJECT SCREENING,

Havana University, Cuba, Centro de Investigaciones Hidraulicas.

J. B. M. Y. Rodriguez, and S. O. Russell. Canadian Journal of Civil Engineering, Vol. 3, No. 1, p 90-97, March 1976. 1 fig, 6 tab, 8 ref, append.

Descriptors: \*Projects, \*Screening, \*Methodology, \*Optimization, \*Planning, Demand, Water resources development, Water supply, Engineering, Algorithms, Costs, Mathematical models, Systems analysis.

Identifiers: \*Sequencing, Cost minimization, Benefit maximization, Sensitivity tests.

Often in the early stages of planning a major development, it is necessary to consider a large number of alternative individual projects and alternative sequences of projects. The main problem at this stage is to screen out the less desirable projects quickly so that only a manageable number of the more promising ones remain for detailed study. A number of simple techniques are presented which can be used to assist the screening process. These include a method for finding the sequence of projects which will meet one or more projected demands at minimum discounted cost, and making a sensitivity test of the results; a method for finding the sequence of projects which would yield the maximum present value of benefits; and a way of finding the optimal planning horizon for facilities where there are economies of scale. A comparison is given between results obtained by the sequencing technique presented and results from a more rigorous but more elaborate and time consuming method for the case of multiple demands. The information and techniques presented herein could prove valuable to those involved in water resources development. (Bell-Cornell)  
W76-08073

#### APPLICATION OF LINEAR PROGRAMMING OPTIMIZATION TO A NORTHERN ONTARIO HYDRO POWER SYSTEM,

Environment Canada, Ottawa, Ontario, Water Planning and Management Branch.

For primary bibliographic entry see Field 4A.  
W76-08074

#### ANALYSIS OF MODELS FOR COMMERCIAL FISHING: MATHEMATICAL AND ECONOMIC ASPECTS,

Cincinnati University, Ohio.

For primary bibliographic entry see Field 6C.  
W76-08078

#### MULTIATTRIBUTE WATER RESOURCES DECISION MAKING,

Rockwell International, Anaheim, California, Autometrics Division.

For primary bibliographic entry see Field 6B.  
W76-08079

#### A REALISTIC APPROACH TO RIVER BASIN DEVELOPMENT,

International Water Resources Association, New Delhi, India.

For primary bibliographic entry see Field 4A.  
W76-08081

#### INTEGRATED DEVELOPMENT OF THE VARAD/AXIOS RIVER BASIN,

United Nations, New York, N.Y.

For primary bibliographic entry see Field 4A.  
W76-08082

## Field 6—WATER RESOURCES PLANNING

### Group 6A—Techniques Of Planning

W76-08082

**AGGREGATE MODELING OF WATER DEMANDS FOR DEVELOPING COUNTRIES UTILIZING SOCIO-ECONOMIC GROWTH PATTERNS,**  
Oklahoma University, Norman, Bureau of Water and Environmental Resources Research.  
For primary bibliographic entry see Field 6D.  
W76-08083

**SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08085

**METHODOLOGY FOR THE SELECTION AND TIMING OF WATER RESOURCES PROJECTS TO PROMOTE NATIONAL ECONOMIC DEVELOPMENT,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6B.  
W76-08091

**OPTIMAL SIZING OF URBAN FLOOD CONTROL SYSTEMS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08092

**PUBLIC HEALTH ASPECT OF TROPICAL WATER RESOURCES DEVELOPMENT,**  
Nigeria Univ., Nsukka. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W76-08096

**PROBLEMS IN FORECASTING WATER REQUIREMENTS,**  
Research Inst. for Water Resources Development, Budapest (Hungary).  
For primary bibliographic entry see Field 6D.  
W76-08098

**A SIMULATION MODEL FOR OPERATING A MULTIPURPOSE MULTIRESERVOIR SYSTEM,**  
Acres Consulting Services Ltd., Niagara Falls (Ontario).  
For primary bibliographic entry see Field 4A.  
W76-08099

**THE DEVELOPMENT OF WATER MULTIPLIER IMPACTS FROM INPUT-OUTPUT ANALYSIS: AN EMPIRICAL EXAMPLE FROM BOULDER, LARIMER, AND WELD COUNTIES, COLORADO,**  
Colorado State Univ., Fort Collins. Dept. of Economics.  
For primary bibliographic entry see Field 6D.  
W76-08100

### 6B. Evaluation Process

**WATER PROBLEMS AND RESEARCH NEEDS FOR HAWAII: 1975,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
I. S. Lau.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-252 764, \$5.00 in paper copy, \$2.25 in microfiche. Technical Report No. 95, February 1976. 77 p, 15 ref, 3 append. OWRT B-039-HI (1) 14-31-0001-4011, 14-31-0001-5011.

Descriptors: \*Regional analysis, \*Regional development, Information dissemination, \*Research priorities, \*Hawaii, \*Research and development.  
Identifiers: Potential users, Technology transfer.

Because of their insular subtropic and volcanic environment, Hawaii and similar regions have special water problems and study needs not duplicated in the temperate continental region. Hawaii's water problems have also changed over past two decades as the economic base has progressed from a primarily agricultural existence to a mixture of urban-recreation-tourism, plantation agricultural, commercial-industrial, and military and governmental activities. Existing and emerging water problems and study needs have been identified for Hawaii in a 1974-1975 joint study by the Hawaii Water Resources Regional Study and the University of Hawaii's Water Resources Research Center. Among the nine water problem areas in water quantity water quality, environmental impact, and water planning and management, over 20 specific study needs have been identified. The historical and recent water study association and cooperation between Hawaii and other Pacific islands, including Guam, is described.  
W76-07584

**PUBLIC PERCEPTION OF POLLUTION CONTROL,**  
Council on Environmental Quality, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07690

**STRATEGIES FOR NATURAL RESOURCE DECISION MAKING: INTERIM REPORT TO THE NEW ENGLAND GOVERNOR'S CONFERENCE.**  
New England River Basins Commission, Boston, Mass.  
Available from the National Technical Information Service, Springfield, Va 22161, as PB-241 026, \$3.50 in paper copy, \$2.25 in microfiche. Report NERBC-002, December 6, 1972. 15 p.

Descriptors: \*Regions, \*New England, \*Decision making, \*Natural resources, \*Watershed management, \*Governmental interrelations, Programs, Water resources planning act, River Basin Commission, \*Interstate rivers.  
Identifiers: \*New England River Basins Commission, Natural resource strategies.

This strategy recognizes the state as the dominant level of government, acting within the framework of national policies and assistance. The Federal government should establish policies and issue guidelines which interpret policies, offer technical assistance, foster regional cooperation, manage federal lands, and delegate responsibility to federal regional administrators to respond to unique characteristics of states. States should design overall natural resource strategies within state goals, serve as a focal point for monitoring performance of overall strategy and guiding political sub-divisions within the state in their decision making, assure access by local governments to state programs, and participate in interstate and region-wide contexts. Summarized recommendations are: (1) The New England Region should assure that regional interests are accounted for at state and federal levels by analyzing regional problems, advancing possible solutions, strengthening communications among various levels of government, and developing mechanisms to secure integration of natural resources decision making strategies. (2) The Commission should serve as a focal point for developing and refining regional strategies by coordinating various plans, preparing and updating a comprehensive regional plan and other plans. (3) The Commission is the appropriate agency for development of regional aspects of land use, coastal zone, water quality,

and other natural resource programs. (4) This region should make appropriate use of other regional institutions to implement natural resources management programs. (5) The New England region should consider modifications of regional arrangements to increase desirable strategies for decision making. (Smith-North Carolina)  
W76-07735

### THE SCIENTIST AND DECISION MAKING AT LAKE TAHOE,

P. Meyer.

In: Proceedings: Lake Tahoe Research Seminar II, 27 September 1974, Sands Vagabond Convention Center, South Lake Tahoe, California, Report No. NSF/RA/G-74-012, p 23-33.

Descriptors: \*Decision making, \*Administration, \*Management, \*Planning, \*Scientific personnel, Land use, Environment, Political aspects, Local governments, Governments.

Identifiers: \*Lake Tahoe(Nev - Calif.).

The Ward Valley Plan adopted by Placer County, Nevada, in 1970 was investigated in an attempt to determine the ways scientists influence the content of public policies. To gather data, 40 interviews were conducted, public documents were examined, and public hearings were attended. It was found that the suggestion to make a land-use plan for Ward Valley first came from the technicians on the county staff, who initially determined both the nature of the problem that faced the county and the general approach the county would take to solve it. After developing their proposal, the staff presented it to the planning commission and received permission to produce a plan. After gathering information, the staff drafted a plan without much direction from the commissioners or supervisors. The staff presented their plan at public hearings. It was the only such plan presented; no one besides the staff had invested the time and energy to produce a detailed plan for the Valley. Consequently, the county politicians had no respectable alternative, and the Board of Supervisors simply adopted the plan recommended by the staff. The influence of academic scientists on the Ward Valley Plan was very gradual and unrecognized and occurred over a number of years prior to the staff's work. (See also W76-07793) (Sims - ISWS)  
W76-07795

### SEQUENCING TECHNIQUES FOR PROJECT SCREENING,

Havana University, Cuba, Centro de Investigaciones Hidraulicas.

For primary bibliographic entry see Field 6A.

W76-08073

### MULTIATTRIBUTE WATER RESOURCES DECISION MAKING,

Rockwell International, Anaheim, California, Autometrics Division.

J. H. Dean, and C. S. Shih.

AIEE Transactions, Vol. 7, No. 4, p 408-413, December 1975. 5 fig, 8 ref.

Descriptors: \*Water resources development, \*Decision making, \*Alternative planning, Reservoirs, Evaluation Simulation analysis, Monte Carlo methods, Economics, Social aspects, Systems analysis, Texas.

Identifiers: \*San Angelo(Texas), Multiattribute utility theory, Sensitivity analysis.

Field reconnaissance with decision makers in San Angelo, Texas led to the selection of dependability, environmental degradation, economic growth potential, quantity, quality, cost, social acceptance and flexibility as the important attributes to be considered in their supplementary water resource development decision problem. The application of multiattribute utility to this problem is discussed and a sensitivity analysis embedded

## WATER RESOURCES PLANNING—Field 6

### Cost Allocation, Cost Sharing, Pricing/Repayment—Group 6C

with Monte-Carlo simulation for the ranking of alternatives is presented. The importance of different considerations other than monetary effects is fully demonstrated and integrated in the final decision-making for water resources development. From the San Angelo case study, it may be concluded that monetary consideration can easily be outweighed by other considerations. Multiattribute utility theory can provide a framework of quantitative analysis for decisions involving both tangible and intangible factors. A sensitivity analysis embedded with Monte-Carlo simulation can add extra dimension of reliability to utility assessments. Finally, decision analysis offers an explicit medium of communication to pool the consensus of judgments from a group of decision makers. (Bell-Cornell)  
W76-08079

**PROBLEMS OF REESTABLISHING COMMERCIAL RECREATION BUSINESSES IN NEW YORK FOLLOWING HURRICANE AGNES,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca.  
For primary bibliographic entry see Field 6F.  
W76-08089

**METHODOLOGY FOR THE SELECTION AND TIMING OF WATER RESOURCES PROJECTS TO PROMOTE NATIONAL ECONOMIC DEVELOPMENT,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
W.A. Lemma.  
No. 77, Hydrology Papers, August 1975. 60 p, 7 fig, 11 tab, 79 ref, 3 append.

Descriptors: \*Water resources, \*Projects, \*Timing, \*Methodology, Analytical techniques, Input-output analysis, Simulation analysis, Economic efficiency, Demand, Assessment, Optimization, Cost-benefit ratio, Computer programs, Planning, Mathematical models, Systems analysis.

Developed is a methodology, designed to facilitate the selection and timing of water resources projects to optimally achieve 'a priori' specified national economic development through desired strategies. The methodology is composed of several analytical procedures. An input-output model is used to simulate the national economy, thus further facilitating consistent projections of the elements of final demands in accordance with the national economic development objectives and strategies, and assessing the total and incremental requirements for sectoral outputs of goods and services at designated future time periods. A mathematical model for the selection and timing of water resources projects for their implementation (for the formulation of an optimal national water resources development program) has been developed and its application demonstrated on an example problem. The model incorporates important factors such as economic efficiency of projects, demand targets for project outputs of goods and services necessary to achieve desired national economic growth, resources capabilities and limitations, and project interrelationships. Incorporation of these and other related factors makes the model reflective of the real world problem it is intended to aid in solving. Application of the model to an example problem indicates it to be very useful in the national economic planning process. Further avenues for research and improvement are also revealed. (Bell-Cornell)  
W76-08091

**AN EXPLORATORY SURVEY AND ANALYSIS OF SAILING IN GALVESTON BAY, TEXAS,**  
Texas A and M Univ., College Station. Coll. of Agriculture.  
R. Jarman, and R. B. Ditton.  
Water Resources Bulletin, Vol. 12, No. 2, p 399-413, April 1976. 2 fig, 6 tab, 12 ref.

Descriptors: \*Boating, Facilities, \*Recreation, \*Research, Methodology, Water resources, \*Texas.  
Identifiers: \*Sailing, Use patterns, \*Galveston Bay(Tex), Boating experience, Geographic patterns, Sailing participation.

Participation in sailing has increased dramatically over the past fifteen years. During some periods, the growth in sailing participation has actually exceeded that of other forms of recreational boating. Although increased sailing activity has exerted pressure for policy and facility development, our understanding of sailing is limited. The lack of baseline information systems may be a major reason for the absence of sailing research efforts. The purpose of this paper is to describe the findings of an exploratory survey of sailing in Galveston Bay, Texas. Included are findings on the descriptive characteristics, boat ownership, sailing experience, extent and nature of sailing participation and geographic patterns of sailing of a group of sailing participants in Galveston Bay. Although exploratory in nature, this survey provides an increased understanding of sailing activities as well as difficulties involved in obtaining data. (Bell-Cornell)  
W76-08095

**A SYSTEM FOR EVALUATING SCENIC RIVERS,**  
Purdue Univ., Lafayette, Ind. Dept. of Forestry.  
D. M. Knudson.  
Water Resources Bulletin, Vol. 12, No. 2, p 281-289, April 1976. 2 tab, 7 ref.

Descriptors: \*Evaluation, \*Streams, Rivers, \*Indiana, \*Aesthetics, Water quality, Roads, Banks, Vegetation, Methodology.  
Identifiers: \*Scenic rivers, Rating.

A system is presented for evaluating streams for inclusion in 'scenic river' systems. Rating criteria are proposed which are objective and pertinent to recreational, scenic, and natural qualities of the river and its banks. The criteria should also be selected for simplicity and economy in application. Numerical ratings of eight criteria are shown for Indiana conditions. These were applied to streams meeting minimum qualifications. The rating criteria are measures of bank vegetation, stream course alterations, man-made structures and roads near and across the river, aesthetic quality of the water, and special natural features. (Bell-Cornell)  
W76-08097

### 6C. Cost Allocation, Cost Sharing, Pricing/Repayment

**INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF PARATHION.**  
Midwest Research Inst., Kansas City, Mo.  
For primary bibliographic entry see Field 5G.  
W76-07612

**GENERAL CONSIDERATIONS ON THE CONDITIONS OF THE ADMISSION OF INDUSTRIAL EFFLUENTS INTO WASTE WATER TREATMENT PLANTS FOR TREATMENT TOGETHER WITH URBAN WASTE WATERS, AND ON THE CONTRIBUTIONS BY THE INDUSTRIES TOWARD THE TREATMENT COSTS (VUE GENERALE SUR LES CONDITIONS D'ADMISSION DES EFFLUENTS INDUSTRIELS DANS LES STATIONS D'EQUATION, POUR TRAITEMENT EN MELANGE AVEC LES EAUX USEES URBAINES, ET SUR LA PARTICIPATION INDUSTRIELLE AU COUT DE CE TRAITEMENT).**  
For primary bibliographic entry see Field 5D.  
W76-07634

**THE WATER AND TOTAL OPTIMIZATIONS OF WET AND DRY-WET COOLING TOWERS FOR ELECTRIC POWER PLANTS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 3E.  
W76-07674

**TWO TRILLION OR THREE: THE COST OF WATER QUALITY GOALS,**  
New York State Dept. of Environmental Conservation, Albany.  
For primary bibliographic entry see Field 5G.  
W76-07686

**COST EFFECTIVENESS OF REGIONAL WATER QUALITY MANAGEMENT: SOME SELECTED CASE STUDIES AND GENERAL IMPLICATIONS,**  
Manhattan Coll., Bronx, N. Y. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 5G.  
W76-07687

**FINANCING AND CHARGES FOR WASTEWATER SYSTEMS: ACTIVITIES OF THE JOINT WPFC/ASCE/APWA COMMITTEE,**  
Hazen and Sawyer, New York.  
For primary bibliographic entry see Field 5G.  
W76-07689

**THE IMPACT OF LARGE TEMPORARY RATE CHANGES ON RESIDENTIAL WATER USE,**  
Virginia Polytechnic Inst. and State Univ. Blacksburg. Dept. of Economics.  
For primary bibliographic entry see Field 6D.  
W76-07738

**METHODS AND COSTS OF INDUSTRIAL EFFLUENT TREATMENT,**  
Ciba-Geigy Limited, Duxford, Cambridge, Environmental Technical Services Group.  
For primary bibliographic entry see Field 5D.  
W76-07740

**THE INTERPLAY OF LAW AND TECHNOLOGY IN DEEP SEALED MINING ISSUES,**  
Alfred P. Sloan School of Management, Cambridge, Mass.  
For primary bibliographic entry see Field 6E.  
W76-07816

**DREDGING ON THE MISSOURI RIVER OXBOW LAKES.**  
For primary bibliographic entry see Field 6E.  
W76-07867

**SEWAGE PLANT USES NATURAL FEATURES TO CUT COSTS.**  
For primary bibliographic entry see Field 5D.  
W76-08033

**OPTIONS FOR COST SHARING: COST SHARING ISSUES-DIMENSIONS, CURRENT SITUATION AND OPTIONS.**  
Water Resources Council, Washington, D.C.  
Part 5A. Planning and Cost Sharing Policy Options for Water and Related Land Programs, September 1975. 204 p, 5 fig., 13 tab., 5 append.

Descriptors: \*Cost sharing, \*Federal project policy, \*Equity, Model studies, Government finance, Local governments, Water users, Reimbursable costs, Cost allocation, Cost repayment.

A statement of cost sharing principles is developed from which the appropriate policies for various national objectives may be formulated. Postulated are the basic reasons and the many options for

## Field 6—WATER RESOURCES PLANNING

### Group 6C—Cost Allocation, Cost Sharing, Pricing/Repayment

non-federal cost sharing for water and other natural resources with some judgments on the practicable levels of cost sharing and especially, the financing alternatives. The focus is on the issues for cost sharing defined as: (1) How should water resources projects and programs be financed; (2) who should pay; and (3) what are the appropriate payment terms and conditions for non-federal interests. Three options are developed to provide consistent and equivalent answers. Each option is evaluated with respect to its operations feasibility and its impact on relevant objectives, purposes and program levels. The probable impacts of various cost sharing options and the resulting federal/non-federal shares are judged on: (a) Non-federal willingness and ability to participate; (b) the overall effectiveness in meeting users' needs; (c) satisfying regional and national objectives; and (d) maintaining the longer run integrity of federally-assisted programs for the long-range national needs. A model illustrates an approach by which one can subjectively determine on the fairness principle, what an alternative cost sharing policy should be, and to approximate the various impacts which would result with respect to the federal and non-federal cost shares for each purpose. (Amen-Wisconsin)  
W76-08035

**NEKTON POPULATION DYNAMICS IN THE ALBEMARLE SOUND AND NEUSE RIVER ESTUARIES,**  
North Carolina Univ., Raleigh. Dept. of Zoology.  
For primary bibliographic entry see Field 5C.  
W76-08037

**ANALYSIS OF MODELS FOR COMMERCIAL FISHING: MATHEMATICAL AND ECONOMIC ASPECTS,**  
Cincinnati University, Ohio.  
A. Leung, and A-Y Wang.  
*Econometrica*, Vol. 44, No. 2, p 295-303, March 1976. 6 fig, 10 ref.

Descriptors: \*Commercial fishing, \*Mathematical models, \*Economics, \*Ecology, Fish, Capital, Investment, Prices, Technology, Equations, Systems analysis.  
Identifiers: Lemmas, Equilibrium position.

Dynamic models for commercial fishing have been proposed by various economists in recent years. There is need for a better understanding of the behavior of the dynamic system and of the effect of different parameters. Such knowledge is necessary for forecasting economic trends and for developing procedures to stabilize fish population and economic movement. This paper investigates a simple economic model for the commercial fishing industry. The model is restricted to non-time-lag investment decisions and to the simplest biological equation. Results imply the phenomena of non-explosive fishing capital investment and non-extinctive fishery resources. Both investments and resources will always tend to an equilibrium position. A comparison with a more general model is also made. (Bell-Cornell)  
W76-08078

### 6D. Water Demand

**PERSPECTIVE ON USE OF FRESH WATER FOR COOLING SYSTEMS OF THERMOELECTRIC POWERPLANTS IN FLORIDA,**  
Geological Survey, Tallahassee, Fla.  
For primary bibliographic entry see Field 3E.  
W76-07596

**THE IMPACT OF LARGE TEMPORARY RATE CHANGES ON RESIDENTIAL WATER USE,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Economics.  
T. F. Hogarty, and R. J. Mackay.

*Water Resources Research*, Vol. 11, No. 6, p 791-794, December 1975. 2 tab.

Descriptors: \*Income effects, \*Asymmetry, \*Water rates, \*Water use, \*Elasticity of demand, \*Marginal costs, Substitution effects, \*Water demand.

Identifiers: Arc price elasticity, Mean elasticity.

Recent studies have concluded water use was unresponsive to rate changes in the short run, with any adjustments occurring, if at all, only in the long run. And it was noted that reduction in domestic water use consisted primarily of repairing leaks. However, this paper indicates that (1) residences curtail total and domestic use of water if marginal rates increase significantly; (2) reduction in water usage may be as great in the short run (e.g. 3 months) as in the long run (e.g. 1 year); (3) reduction in water use following a large rate increase is to some extent permanent. The raw data for the study was compiled from monthly water bills at 120 individually owned townhouses in Blacksburg, Virginia. Quarterly averages were used due to unreliable data. Using marginal rates, arc price elasticity estimates were determined for each household. Observed results from the data were: (1) residential water consumption, even for domestic use, is highly sensitive to large increases in (marginal) rates; (2) response to rate increases is as great in the short run as in the longer period; (3) residential water consumption, at least for domestic use, is relatively insensitive to decreases in (marginal) rates following large increases. Income effects, substitution effects and asymmetry (more sensitivity to rate increases than to decreases) are discussed in the analysis. (Gentry-North Carolina)  
W76-07738

**MIXING OIL AND WATER: THE EFFECT OF PREVAILING WATER LAW DOCTRINES ON OIL SHALE DEVELOPMENT,**  
Kutak, Rock, Cohen, Campbell, Garfinkle and Woodward, Omaha, Nebr.  
For primary bibliographic entry see Field 6E.  
W76-07806

**TO AMEND THE LAND AND WATER CONSERVATION FUND ACT OF 1965 AND TO AMEND THE HISTORIC PRESERVATION ACT OF 1966.**  
For primary bibliographic entry see Field 6E.  
W76-07864

**AGGREGATE MODELING OF WATER DEMANDS FOR DEVELOPING COUNTRIES UTILIZING SOCIO-ECONOMIC GROWTH PATTERNS,**  
Oklahoma University, Norman, Bureau of Water and Environmental Resources Research.  
G. W. Reid, and M. I. Muiga.

Working Paper No. 48, UNDP/UN Interregional Seminar on River Basin and Interbasin Development, Budapest, Hungary, September 1975. 21 p, 1 fig, 2 tab, 2 append.

Descriptors: \*Water demand, \*Social aspects, \*Economics, \*Water resources development, Management, Riverbasins, Methodology, Comprehensive planning, Water treatment, Industrial water, Municipal water, Water supply, Equations, Systems analysis, Mathematical models.  
Identifiers: \*Developing countries, Growth patterns (Socio-economic), Aggregate model, Agricultural water.

An aggregate model has been developed, the basic input of which is the sixteen socio-economic parameters representing data that is generally available at a national or basin level in developing countries. The socio-economic inputs identify four activity socio-technological levels, levels representative of status of socio-economic development are in turn used to identify municipal, agricultural and industrial gross water

requirements. The normalized requirements and the normalized resource capabilities in terms of water, energy, arable land, metals and petrochemicals are used as constraints on the projective system. The output or planning level information on total and three basic categorical water requirements that are in balance with the socio-economic growth of developing countries is derived. It is important that this type of model be continuously brought up to date. Data should be collected periodically to be used for validation of the model. Currently, data, especially that for industrial and irrigation water demand, are being collected from developing countries in Africa, Asia, and South America. (Bell-Cornell)  
W76-08083

### PROBLEMS IN FORECASTING WATER REQUIREMENTS,

Research Inst. for Water Resources Development, Budapest (Hungary).  
M. Domokos, J. Weber, and L. Duckstein.  
*Water Resources Bulletin*, Vol. 12, No. 2, p 263-275, April 1976. 1 fig, 62 ref.

Descriptors: \*Water requirements, \*Statistical methods, \*Forecasting, Time series analysis, Social aspects, Economics, Water allocation (Policy), Methodology, Systems analysis, Mathematical models.

Identifiers: \*Long-range predictions, \*Multiple regression analysis.

Methodological problems associated with forecasting water requirements by use of regression analysis are examined. Problems occurring when long-range forecasts are based on linear and nonlinear extrapolation of time series models include possible changes in socioeconomic conditions, water allocation system structure, and limits to growth. Problems arising in forecasting based on multiple regression models are likely to involve serially dependent errors, multicollinear explanatory variables, and difficulties inherent to the presence of explanatory variables that must themselves be predicted. (Bell-Cornell)  
W76-08098

**THE DEVELOPMENT OF WATER MULTIPLIER IMPACTS FROM INPUT-OUTPUT ANALYSIS: AN EMPIRICAL EXAMPLE FROM BOULDER, LARIMER, AND WELD COUNTIES, COLORADO,**  
Colorado State Univ., Fort Collins. Dept. of Economics.  
S. L. Gray, and J. R. McKean.  
*Water Resources Research*, Vol. 12, No. 2, p 135-140, April 1976. 7 tab, 10 ref.

Descriptors: \*Water utilization, \*Input-output analysis, \*Leontief models, \*Economics, Estimating, Water demand, Planning, Water supply, Equations, Mathematical models, Systems analysis, \*Colorado.  
Identifiers: \*Water intake, \*Consumptive use, Regional economy.

The relationship between economic activity in a regional economy and water intake and consumptive use requirements is investigated by using the Leontief model. Estimates of direct and indirect water requirements for the regional economy are developed and are applied to three distinct planning questions: estimated aggregate water use in the regional economy, estimated sector by sector water requirements in response to total projected changes in final demands, and estimated changes in water requirements in the regional economy given a change in a single sector's deliveries to final demand. (Bell-Cornell)  
W76-08100

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

#### 6E. Water Law and Institutions

**PROCEEDINGS: SECOND WETLANDS CONFERENCE (HELD ON JANUARY 9, 1974 AT STORRS, CONNECTICUT),** Connecticut Univ., Storrs. Inst. of Water Resources.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-252 753, \$6.00 in paper copy, \$2.25 in microfiche. Report No. 24, October 1975. 118 p, 14 fig, 1 tab, 3 append. M. W. Lefor, H. H. Ridgeway, T. B. Helfgott, eds. OWRT-B-010-CONN(1), 14-31-0001-5062.

Descriptors: \*Wetlands, \*Legal aspects, \*Political aspects, Soil surveys, Remote sensing, Land use, Boundaries(Property), Economics, Constitutional law.

Identifiers: \*Wetlands definition, \*Environmental aspects, \*Public policy, Thematic maps, The Taking Clause, Connecticut Inland Wetlands Act.

Under the theme of inland wetland conservation, seven edited and reviewed papers concerned with environmental and political science aspects of delineation of wetlands are presented. The conference was held on January 9, 1974, sponsored by the Institute of Water Resources at the University of Connecticut and co-sponsored by the Connecticut State Department of Environmental Protection and the U.S. Soil Conservation Service. The major topics covered are: the identification of freshwater wetland values; methods of delineating wetlands by means of soil surveys; considerations in the preparation of specialized maps; the use of remote sensing in setting criteria for the management of inland wetlands; practical aspects of field determination of wetland boundaries; public policy implications of inland wetlands and water courses laws; and a legal and constitutional discussion on The Taking Issue as it relates to current Acts. The proceedings include specific information and conclusions on these issues as well as illustrations such as maps, reference lists, appendices of Latin and common botanical species names for wetland plants, the National Map Accuracy Standards and a list of conference participants. The proceedings are devoted to the consideration of wetlands for the long-term environmental value of these water and land resources. (deLara-Connecticut)

W76-07451

**WATER RESOURCES ISSUES AND THE 1972 UNITED NATIONS CONFERENCE ON THE HUMAN ENVIRONMENT,** Massachusetts Inst. of Tech., Cambridge. Dept. of Civil Engineering.

For primary bibliographic entry see Field 5G.

W76-07688

**STRATEGIES FOR NATURAL RESOURCE DECISION MAKING: INTERIM REPORT TO THE NEW ENGLAND GOVERNOR'S CONFERENCE.**

New England River Basins Commission, Boston, Mass.

For primary bibliographic entry see Field 6B.

W76-07735

**WILL INDUSTRY MEET WATER QUALITY REQUIREMENTS,**

For primary bibliographic entry see Field 5G.

W76-07736

**PROPOSED KAIPAROWITS PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT.**

For primary bibliographic entry see Field 6G.

W76-07800

#### NEBRASKA DISPOSAL WELLS REGULATIONS.

Nebraska State Dept. of Environmental Control, Lincoln.  
For primary bibliographic entry see Field 5G.  
W76-07801

#### REGISTRATION OF LIQUID WASTE HAULERS AND WASTE DISPOSAL TO LAND,

For primary bibliographic entry see Field 5G.  
W76-07802

#### MODELS FOR IMPLEMENTING THE CZMA'S CONCEPT OF STATE-LOCAL RELATIONS,

Nassau-Suffolk Regional Planning Board, N. Y. L. E. Koppleman.

William and Mary Law Review, Vol. 16, No. 4, p.

731-46 (1975). 16 p, 3 fig.

Descriptors: \*Administrative agencies, \*State governments, \*Comprehensive planning, \*Coastal engineering, \*Water management(Applied), Coastal marshes, Coastal plains, Water control, Local governments, Water law, Water policy, Water conservation, State jurisdiction, Planning, Management, Optimization, Decision making, Land management, Marsh management, Coordination, Systems analysis, Project planning, Political aspects.

Identifiers: \*Coastal Zone Management Act, Coastal zone management, Coastal waters.

Evaluated in this article are various governmental structures which could be used to manage the coastal zone. The Coastal Zone Management Act encourages the development of such structures by requiring participating states to include comprehensive management plans describing the governmental unit which will administer the program and the methods chosen. Local regulation in accordance with state-established standards and local regulation subject to state review are two options available to the states. Any plan adopted must also be weighed in light of political considerations because of the prevalent 'home rule' practice of states. The states are responsible for the development of criteria and guidelines to be used by local governments whichever model of coastal zone planning is chosen. Since effective planning requires extensive research so that rational control can be accomplished, interim provisions, such as consolidation of all existing legislation or regulatory proceedings into a single measure, should be implemented until a comprehensive plan can be adopted. Regulation by local governmental units can achieve coordinated management of coastal zones if multi-state cooperation can produce effective and comprehensive guidelines. (Welch-Florida)

W76-07803

#### COASTAL BOUNDARY LITIGATION WITH THE STATE: A FRAME OF REFERENCE,

Florida State Dept. of Environmental Regulation, Tallahassee.

R. A. McVoy.

Florida Bar Journal, Vol. 49, No. 10, 579-84 (1975).

6p.

Descriptors: \*Elevation, \*Boundaries(Property), \*Boundary disputes, \*High water mark, \*Coasts, Water law, Legal aspects, Meanders, Tides, Tidal waters, Bodies of water, Tidal marshes, Legal review.

Identifiers: \*Extrapolated water elevation, \*Meander line.

When reviewing abstracts of coastal lands, it is important to remember that private title generally extends only to the mean high water line. The procedures for demarcation of the mean high water line are set forth in Florida State Board of Professional Engineers and Land Surveyors. Several techniques are available in determining the line, such as the extrapolated water elevation

method and the control tide station method. Problems often arise, however, which make it impossible for a surveyor to locate the mean high water line. In such cases, a judicial determination should be sought that will recognize some other line as the legal boundary line. In one important Florida decision, it was held that the meander line constituted the legal boundary line. Whether that case reached a valid decision is questionable since meander lines are often found to cut into upland areas in some place and into open water in others. Several other Florida cases suggest that ebb and flow concepts might be preferable in determining boundary lines, but these cases too are open to doubt. Consequently, numerous factors must be considered in determining the legal boundary line of a client's coastal property. (Hoffman-Florida)

W76-07804

#### PROPERTY TAX LAWS OF TEXAS,

J. D. Howell, Jr.

Texas Real Estate Research Center, College Station, 1975, 90 p, \$1.00.

Descriptors: \*Texas, \*Taxes, \*Legislation, \*Water resources, \*Constitutional law, Legal aspects, Assessments, Conservation, Gulf of Mexico, Local governments, Water districts, Coastal structures, Sea walls, Breakwaters, Ferry boats, Bridges.

Identifiers: \*Ad valorem taxes, Property taxes.

This booklet presents a simplified view of the laws and procedures involved in administering the ad valorem property tax in Texas. Tax provisions relating to water districts are touched on briefly. The appendix contains the constitutional provisions pertaining to property taxation. The sections concerned with water resources include: (1) Article 111, dealing with legislation relating to ferries and bridges; (2) Article XI, Section 7, permitting counties and cities on the Gulf of Mexico to levy property taxes for the construction of seawalls, breakwaters or sanitary purposes; and (3) Article XVI, Section 59, providing for the creation of conservation and reclamation districts for the purpose of conserving and developing all of the natural resources of the state. (Capehart-Florida)

W76-07805

#### MIXING OIL AND WATER: THE EFFECT OF PREVAILING WATER LAW DOCTRINES ON OIL SHALE DEVELOPMENT,

Kutak, Rock, Cohen, Campbell, Garfinkle and Woodward, Omaha, Nebr.

W. E. Holland.

Denver Law Journal, Vol. 52, No. 3, p. 657-94 (1975). 38 p, 2 map, append.

Descriptors: \*Colorado, \*Oil shales, \*Water supply, \*Mineral industry, \*Water allocation(Policy), Water resources, Water rights, Oil, Water law, Appropriation, Beneficial use, Groundwater, Surface waters, Prior appropriation, Priorities, Preferences(Water rights), Water delivery, Federal government, Federal jurisdiction, Federal reservations, National forests, Utah, Wyoming.

Identifiers: \*Green River Formation, 'Law of the river.'

The Green River Formation underlying several basin areas in Colorado, Utah, and Wyoming is the most commercially significant oil shale formation in the world. No shale oil has yet been produced, however, due to difficulties in separating the oil from the rock and in acquiring a sufficient water supply. As to the water supply, natural limits are not the source of the problem. The Colorado River Compact, the Mexican Water Treaty, and the Upper Colorado River Basin Compact artificially limit availability of water supplies in the oil shale areas. In addition ground waters and surface waters are considered public property and thus are subject to allocation through prior appropriation systems in the shale oil states. Consequently,

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### Group 6E—Water Law and Institutions

water for production purposes can be acquired only by acquiring existing appropriation rights or by filing applications for unappropriated water. The filing of applications also has problems, though, for state laws give preference for certain uses of water. The ultimate solution may be a system whereby water delivery rights can be purchased analogous to contract rights for utilities. Another potential solution involves the doctrine of federal reserved rights whereby the oil industry could possibly obtain water supplies on lands otherwise reserved for naval oil shale reserves, national forests and Indian Reservations. (Hadoulias-Florida)

W76-07806

**ISSUES TO BE RESOLVED IN THE SECOND SUBSTANTIVE SESSION OF THE THIRD UNITED NATIONS CONFERENCE ON THE LAW OF THE SEA,**  
Department of State, Washington, D. C. Office of the Assistant Legal Adviser for Ocean Affairs.  
B. H. Oxman, and M. B. West.

Columbia Journal of Transnational Law, Vol. 14, No. 1, p. 87-101 (1975).

Descriptors: \*United Nations, \*International waters, \*International law, \*Law of the sea, \*Continental shelf, United States, Navigation, Navigable waters, Military aspects, Oceans, Water policy, Reasonable use, Marine fisheries, Fishing, Migration, Commercial fisheries, Legal aspects, Water law, International law, Foreign waters, Continental margin, Straits, Commercial fishing.

Identifiers: \*Deep seabed mining, United Nations Conference on the Law of the Sea(UNCLOS), Territorial seas, International navigation, Deep seabed resources.

Three committees were charged with resolution of the various issues facing the second substantive session of the Third United Nations Conference on the Law of the Sea. Issues relating to deep seabed resources were charged to Committee I, navigation and resources other than deep seabed resources to Committee II, and issues centered around pollution and scientific research to Committee III. Previous sessions of Committee I have resulted in strong political and ideological confrontations among nations whose interests differ in the matter of deep seabed mining. In comparison, Committee II has reached substantial agreement on major jurisdictional questions related to 12-mile territorial seas and 200-mile economic zones. Committee III, however, has to date failed to produce a text on some major pollution concerns, and has not resolved some basic questions involving scientific research. All three committees face the need for designing a satisfactory dispute settling mechanism which will result in binding decisions when other means of settlement fail. The authors outline in detail the major problem areas faced by the Conference. (Sloan-Florida)

W76-07807

**APPLICATION OF THE WINTERS DOCTRINE: QUANTIFICATION OF THE MADISON FORMATION,**  
M. M. Hickey.  
South Dakota Law Review, Vol. 121, No. 1, p. 144-59 (1976). 16 p.

Descriptors: \*South Dakota, \*Indian reservations, \*Preferences(Water rights), \*Federal-State water rights conflicts, \*Aquifers, Groundwater, Groundwater resources, Aquifer management, Water rights, Irrigation, Water demand, Water management(Applied), Water users, Water requirements. Identifiers: \*Winters doctrine.

As the population of South Dakota grows and existing surface water supplies decrease, groundwater becomes increasingly important as an alternative source of supply. However, the state's development of its abundant sources of ground-

water is tempered by the rights of the Indians as provided in the Winters Doctrine. The Doctrine derives its name from the case *Winters v. United States*, 207 U.S. 564 (1908), and provides that whenever the United States by treaty, act of Congress or executive order, reserves and withdraws a portion of land from the public domain for a federal purpose which will ultimately require water, absent an intent otherwise, a sufficient amount of water to accomplish that purpose is reserved. This article examines the application of the Winters Doctrine to the subsurface waters of the Madison Formation, a large aquifer in South Dakota. It also discusses various methods of quantifying Indian rights to those waters by virtue of the Doctrine. The article concludes with a discussion of the effect of the proposed National Water Rights Procedures Act on the Winters Doctrine and appeals for a balancing of rights to water supplies between Indian and non-Indian competitors. (Lasris-Florida)

W76-07808

**ENVIRONMENTAL LAW: WHAT IS 'MAJOR' IN 'MAJOR FEDERAL ACTION', MINNESOTA PUBLIC INTEREST RESEARCH GROUP V. BUTZ,** 498 F2d 1314 (8TH CIR. 1974).

Washington University Law Quarterly, Vol. 1975, No. 2, p. 485-94. 10 p.

Descriptors: \*Legal review, \*Administrative agencies, \*Federal government, \*Standards, \*Permits, Legal aspects, Judicial decisions, Environmental effects, Regulation, Forest management, Lumbering, \*Minnesota, Dams, Road construction, Watershed management, Construction, Electric power plants.

Identifiers: \*National Environmental Policy Act, Administrative regulations, Environmental impact statement.

The trend in the federal court system appears to be toward a careful judicial scrutiny of an agency's decision not to prepare an environmental impact statement (EIS). The author examines the various methods used by the courts to determine whether a federal action is major and significant within the coverage of the National Environmental Policy Act (NEPA). The methods frequently lead to inconsistent results. Cases in which the courts have consistently found agency action to require an EIS include highway construction, dams and watershed projects, electric power projects and building construction. The author examines Minnesota Public Interest Research Group V. Butz, and Eighth Circuit Court of Appeals decision which enjoined logging operations in the Boundary waters Canoe Area until the United States Forest Service could file an environmental impact statement. He concludes that the case is consistent with the judicial view of NEPA as an "environmental full-disclosure law". (Capehart-Florida)

W76-07809

**PROPERTY-SUSCEPTIBILITY OF BEDS OF NAVIGABLE WATERS TO PRIVATE OWNERSHIP,**  
S. H. Kupperman.

Tulane Law Review, Vol. 50, No. 1, p. 193-200 (1975). 8 p.

Descriptors: \*Land tenure, \*Louisiana, \*Ownership of beds, \*Navigable waters, \*Royalties, Beds, Judicial decisions, Legal review, Legal aspects, Compensation, Cost repayment, Prior appropriation, Public lands, State governments.

Identifiers: Public trust doctrine, Mineral rights.

The present position of the Louisiana Supreme Court is that the beds of all navigable waterways within the state are and always have been completely insusceptible of private ownership. This position overrules prior Louisiana case law and is likely to provoke further litigation to determine the rights of private parties claiming ownership.

ship. Individuals who previously had valid claims of ownership may have a right to reimbursement. The author discusses the additional problem of whether the owners of the mineral rights have any further claim on royalty payments from submerged properties. (Capehart-Florida).

W76-07810

**STATE RESPONSIBILITY AND THE LAW OF INTERNATIONAL WATERCOURSES,**  
Lewis Univ., Lockport, Ill. Coll. of Law.

T. O. Holstein.

Lawyer of the Americas, Vol. 7, No. 3, p. 535-55 (1975). 21 p.

Descriptors: \*International law, \*Navigable waters, \*Governmental interrelations, \*Oil pollution, \*Oil spills, Water pollution, Legal aspects, Treaties, International waters, Rivers, Navigable rivers, River systems, Watersheds(Basins), River basins, Water pollution effects, Political aspects, United Nations, Governments, Legislation, Watercourses(Legal aspects), Foreign countries.

The International Law Commission of the United Nations is studying the law of non-navigational uses of international waterways with a view to its development and codification. In general the area of non-navigational uses includes state responsibility for extra-territorial injury caused by the pollution of international rivers. The author examines various methods of creating state responsibility for extra-territorial injury. Treaties generally are ineffective. However, since treaties creating objective regimes have a greater authority to bind non-signatory states than most multi-lateral treaties, they may be uniquely suited to deal with pollution of international watercourses. The author concludes that the Commission should limit its codification of international watercourses to specific non-navigational uses. Since pollution is not a use but the result of use, state responsibility for pollution should be included in the codification of general state responsibility. (Capehart-Florida)

W76-07811

**OIL TANKER POLLUTION CONTROL: DESIGN CRITERIA VS EFFECTIVE LIABILITY ASSESSMENT,**

Department of the Treasury, Washington, D.C.

For primary bibliographic entry see Field 5G.

W76-07812

**THE REGULATION OF DEEPWATER PORTS,**  
For primary bibliographic entry see Field 5G.

W76-07813

**INTERNATIONAL SEABED RESOURCES: THE U. S. POSITION,**  
D. C. Ohly.

Virginia Journal of International Law, Vol. 15, No. 4, p. 903-25, (1975) 23 p.

Descriptors: \*Exploitation, \*Continental shelf, \*International Law, \*Law of the sea, \*Mineral industry, Mining, Manganese, Exploration, Cobalt, Copper, Nickel, Navigation, Metals, Mineralogy, Resources, Resource development, Oceans, International waters, Foreign waters, Treaties, United Nations, United States.

Identifiers: \*Deep seabed mining, Territorial sea, United Nations Conference on the Law of the Sea(UNCLOS), Mineral nodules, Marine resources, Developed countries, Developing countries.

One of the motivating factors, for convening the Law of the Sea Conference was the assertion and threatened future assertion of national claims of functional or territorial jurisdiction over large ocean areas for the purpose of mineral exploitation. This jurisdictional issue has caused a direct conflict between the developed and developing countries. Nations possessing high technology in-

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

dustries, with a consequent need for minerals found on the deep seabed, are faced with pressure unilaterally to exploit these mine beds. Developing nations, on the other hand, are concerned that their access to mine sites will be foreclosed by their present technological incapacities. In an attempt to resolve this conflict, the United Nations Law of the Sea Conference is considering the creation of an International Seabed Authority to regulate the mining of seabed resources. The United States position, which is representative of other developed countries, is that the proposed authority must balance the interests of the world community with reasonable safeguards for providing a stable investment environment for prospective developers. The developing nations, however, have proposed that the authority have very broad regulatory powers, including discretionary imposition of price and production controls. The author discusses the alternative proposals and expresses hope for a satisfactory compromise in the Third Substantive Session of the Conference scheduled to commence in New York in March, 1976. (Sloan-Florida)

W76-07814

#### ENVIRONMENTAL ASPECTS OF DEEP SEA MINING,

Center for Law and Social Policy, Washington, D.C.

R. A. Frank.

Virginia Journal of International Law, Vol. 15, No. 4, p 815-26 (1975). 12 p.

Descriptors: \*Exploitation, \*Metals, \*Marine biology, \*Mining, \*Continental shelf, Sea water, Copper, Cobalt, Nickel, Water pollution, Water pollution sources, Environment, Ecology, Deep water habitat, Mining wastes, United Nations, United States, Sediments, Resources, Manganese, Law of the sea, Foreign countries.

Identifiers: \*Mineral nodules, \*Deep seabed mining, \*Ocean mining, \*Ocean floor mining, United Nations Law of the Sea Conference(UNCLOS), Department of Interior.

The United States now imports approximately 95% of its manganese, 72% of its nickel, 15% of its copper, and 100% of its cobalt. In the last decade, several American and foreign companies have begun to develop systems for retrieving and processing mineral nodules found on the ocean floor. Within three years or so, technology will exist for commercial exploitation of these nodules, either by scraping the seabed with buckets, or by using a vacuum cleaner type suction system. While most of the nations of the world would gain economically from the resulting reduction in material costs, the resulting environmental effects of such exploitation are unknown. The Department of Interior has strongly recommended further study before attempting to assess the implications of deep seabed mining. Possible adverse effects of ocean floor mineral exploitation could include disturbance of unknown fauna and alteration of photosynthetic processes. The author discusses these and other possibilities, and outlines the potential environmental consequences of proposed domestic legislation and of the international regime being considered by the United Nations Law of the Sea Conference. (Sloan-Florida)

W76-07815

#### THE INTERPLAY OF LAW AND TECHNOLOGY IN DEEP SEABED MINING ISSUES,

Alfred P. Sloan School of Management, Cambridge, Mass.

J. D. Nyhart.

Virginia Journal of International Law, Vol. 15, No. 4, p. 827-68 (1975). 32 p.

Descriptors: \*Exploitation, \*Treaties, \*Mineral industry, \*International law, \*Law of the sea, Manganese, United Nations, Mining, United States, International waters, Oceans, Mineralogy, Mining engineering, Nickel, Continental shelf, Oil indus-

try, Technology, Regulation, Foreign waters, Copper, Governments, Foreign countries. Identifiers: Manganese nodules, \*Deep seabed mining, Marine environment, Mining systems.

New technology inevitably creates new legal responses. As a result of recent technological developments in the area of deep seabed mineral exploitation, the United Nations Conference on the Law of the Sea is attempting to construct a multi-national treaty which will govern use of international waters. Recent international negotiations have produced no apparent reconciliation between the industrialized nations, which support a system of licensing and regulation, and the developing countries, which support a system of full control of mining operations by an International Seabed Authority. Strong pressures are being brought to bear on the United States Government by American mining interests and their foreign consortium partners to pass legislation unilaterally extending regulatory control over United States nationals engaged in deep seabed mining. As an interim measure, such law might contribute to the experience of regulating new technology which would be necessary for the creation of an international regime. The author discusses various proposals and their possible consequences in relation to economic, environmental, and technological interests. (Sloan-Florida)

W76-07816

#### DISPARATE FISHERIES: PROBLEMS FOR THE LAW OF THE SEA CONFERENCE AND BEYOND,

Resources for the Future, Inc., Washington, D.C.

F. T. Christy, Jr.

Reprint No. 115, Summer, 1974.

Descriptors: \*Marine fisheries, \*Commercial fishing, \*Law of the sea, \*Foreign countries, Fish, Aquatic animals, Fish populations, Marine fish, Regulation, Legal aspects, International law, International waters, Surface waters, Fish conservation, Fish management, Fish harvest, Indian Ocean, United States.

Identifiers: \*Coastal zone management, Coastal waters, West Africa, Northern Pacific Ocean.

There is little uniformity in the major fisheries throughout the world. This is shown by studies undertaken by the Program of International Studies of Fisheries Arrangements. These studies, conducted in anticipation of problems facing the UN Law of the Sea Conference, Conference, covered a variety of fishery regions. The North Pacific region involves a small number of states interested in fisheries, relatively few species of fish and regulations placed on limited stocks. Problems include: (1) higher world prices; (2) entry of new states; and (3) narrow agreements providing inadequate coverage of state's needs. About forty states are involved in the West Africa region where a large number of different species of fish resulted in rapid growth, in turn threatening depletion of stocks. Strict fisheries management and controls to prevent further waste are needed. Indian Ocean fisheries are underdeveloped with a significant potential for increased catch. The tuna fisheries require more stringent controls because of pressures exerted on the stocks. The uniform control necessary is impeded by the tuna's mobility and wide distribution. The Department of Fisheries of the Food and Agriculture Organization of the UN must take a more active role in providing the needed information, research and regulation. (Griffith-Florida)

W76-07817

#### THE HAWAIIAN ARCHIPELAGO DEFINING THE BOUNDARIES OF THE STATE,

Hawaii Univ., Honolulu. School of Law.

R. G. Schmitt, L. K. C. Luke, E. Yee, R. E.

Strand, and C. Kerns.

University of Hawaii Sea Grant College Program, Working Paper No. 16, (October 1975). 103 p, 1 tab.

Descriptors: \*Hawaii, \*Boundaries(Property), \*Islands, \*International waters, \*Federal-state water rights conflicts, Jurisdiction, Federal jurisdiction, State jurisdiction, Pacific Ocean, Oceans, Law of the sea, Natural resources, Governmental interrelations, Administrative agencies, Economic impact, Political aspects, Legal aspects, Coral, Manganese, Fishing. Identifiers: \*Archipelago, Ocean thermal energy.

The chain of Hawaiian Islands is an integrated geophysical and biophysical configuration with most of its biological and mineral resources located in international waters. Uncontrolled exploitation of the resources in international waters poses environmental and economic threats to that portion of the resources within state jurisdiction. The authors examine the proposed claim of archipelagic status for Hawaii to determine benefits and problem areas. The discussion of methods for expanding the jurisdictional boundaries includes: (1) ocean claim theories; (2) treaties and international organizations; (3) unilateral state claims to extended jurisdiction; (4) United States oceanic claims; and (5) Hawaiian ocean claims. Island nations currently making archipelagic claims base them on the historic boundaries, the economic dependence on ocean resources, the need for state security, and the need to promote unity by placing connecting seas under state jurisdiction. The authors also analyze the effects of boundary expansion on the agencies of state government, the possible conflicts between state and federal government in areas where the federal government currently maintains controls, and the ocean resources of Hawaii which include fish, precious coral, deposits of manganese nodules and potential alternative energy sources. (Capehart-Florida)

W76-07818

#### THE WATER SUPPLY OF ROME,

College of Physicians of Philadelphia, Pa.

For primary bibliographic entry see Field 4A.

W76-07819

#### NON-POINT POLLUTION IN THE POTOMAC RIVER BASIN,

Interstate Commission on the Potomac River, Bethesda, Md.

For primary bibliographic entry see Field 5B.

W76-07820

#### CLEAN WATER FOR MID-AMERICA.

Federal Water Pollution Control Administration, Chicago, Ill. Great Lakes Region.

For primary bibliographic entry see Field 5G.

W76-07821

#### THE ROLE OF NORTH CAROLINA IN REGULATING OFFSHORE PETROLEUM DEVELOPMENT,

North Carolina Univ. at Chapel Hill. School of Law.

J. E. Kilpatrick.

Available from the National Technical Information Service, Springfield, Va 22161, as COM-75-10854, \$4.00 in paper copy, \$2.25 in microfiche. Sea Grant Publication, UNC-SG-75-09, April 1975, 29p.

Descriptors: \*North Carolina, \*Oil, \*Water pollution, \*Continental shelf, \*Planning, Beds, Legislation, Natural resources, Oil pollution, International waters, Oil spills, Boundaries(Property), Jurisdiction, State governments, Federal government, Governmental interrelations, Political aspects, Oil industry, Navigable waters, Permits, Administrative agencies, Regulation, Dredging, Coasts, Zoning.

Identifiers: \*Coastal zone management, Coastal waters, Absolute liability, Administrative regulations, Fill permits.

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

This pamphlet analyzes the existing legal framework to determine whether the state interests affected by offshore petroleum development are adequately protected. Effective planning and regulation of activities related to the state's submerged lands and outer continental shelf resources requires precise knowledge of the areas subject to state ownership and control. The northern and southern lateral seaward boundaries of North Carolina are unsettled at present. The relationship between state, federal and international jurisdiction over offshore submerged land resources is also uncertain. To insure that the State is aware of the stakes involved in settling these uncertainties, an extensive geologic inventory of the mineral resources within the inland and offshore submerged lands should be made. As to lands within state jurisdiction, the Department of National and Economic Resources should promulgate regulations for oil production from submerged lands. Other regulatory control could be obtained through the permit requirements of the state dredge and fill law and the federal Rivers and Harbors Act. These controls are aimed at pollution control, rather than pollution compensation, since both the state and federal government currently impose liability for oil spill damage. In addition to the above regulatory controls, Zone Management Act would allow regulation of drilling by declaring the submerged lands 'areas of environmental concern'. The author concludes that much more state and local planning, regulation and legislation are essential to sound development of petroleum deposits in North Carolina. (Capehart-Florida)  
W76-07822

#### LEGAL CONSIDERATIONS FOR THE CONSTRUCTION AND OPERATION OF A DEEP-WATER OIL TERMINAL IN THE DELAWARE BAY,

Delaware Univ., Newark. Coll. of Marine Studies. Center for Study of Marine Policy, Report CMS-7-75, Sept 1975, 27p.

Descriptors: \*Delaware, \*Oil, \*Bays, \*Permits, \*Structures, Delaware River, Delaware River Basin Commission, Legal aspects, Pipelines, Storage tanks, State governments, Federal government, Coasts, Beds, Streams, Federal Water Pollution Control Act, Water quality, Water pollution, Legislation, Governmental interrelations, Regulation, Administrative agencies, Interstate compacts, Interstate commissions, Navigable waters.  
Identifiers: \*Delaware Coastal Zone Act, \*Deepwater oil terminal, Administrative regulations, Coastal zone management, Coastal waters, Environmental impact statement, Corps of Engineers.

The right to sell, lease or permit submerged lands in Delaware Bay to be used for a deepwater oil terminal is limited by state statutes, interstate compacts and federal interests. The Delaware Coastal Zone Act presently prohibits such a terminal. County zoning regulations may entail county approval of the onshore storage tanks and pipelines needed to service a terminal facility. Permits from both the Delaware Department of Natural Resources and the Delaware River Basin Commission are required for each pipeline crossing of any stream flowing into the Delaware River and Bay. The Commission also has authority over any construction in the bay affecting water quality. Although the Delaware River and Bay Authority has claimed sole jurisdiction over any terminal construction in the bay, the authors conclude that such a position is untenable. The federal agencies concerned include the Corps of Engineers, the U.S. Coast Guard, the Environmental Protection Agency, the U.S. Fish and Wildlife Service, and the Department of Commerce. An environmental impact statement would be required. The authors propose that any legislation permitting a terminal should provide for oil spill liability. (Capehart-Florida)  
W76-07823

#### PUBLIC RIGHTS IN GEORGIA'S TIDELANDS,

Georgia Univ., Athens. Inst. of Government. J. O. Smith, and J. L. Sammons. Georgia Law Review, Vol. 9, p 79-114 (1974). 36p.

Descriptors: \*Georgia, \*Wetlands, \*Tidal waters, \*Coastal marshes, \*Riparian rights, \*Public rights, Shellfish, Oysters, Clams, State jurisdiction, Riparian waters, Estuaries, Estuarine fisheries, Tidal streams, Fishing, Public access, Navigable waters, Constitutional law, Non-navigable waters. Identifiers: Foreshore, Tidelands, Public trust, Intertidal areas.

Since tidelands have a unique public value which is inconsistent with private ownership and control, the government has an obligation to regulate their use. This principle, the public trust doctrine, has evolved through the centuries. In discussing the status of public rights in the foreshore under present Georgia law, the authors trace the development of the doctrine under antecedent legal systems such as Roman civil codes, English common law and parliamentary statutes, and early American federal law. Interest in private shellfisheries and public fishing rights occupied a predominant position in the development of Georgia policy and culminated in the Georgia Tidelands Act of 1902, which recognized certain public rights in the foreshore. The Georgia Attorney General, however, has recently questioned the validity of the Act under the Georgia Constitution and recent case law addressing this problem has resulted in uncertainty as to public rights in non-navigable tidal streams. The authors urge that proper construction of existing law should continue protection of public trust doctrine is a valid basis for any regulatory scheme. (Sloan-Florida)  
W76-07824

#### SCIENTIFIC RESEARCH ARTICLES IN THE LAW OF THE SEA INFORMAL SINGLE NEGOTIATING TEXT,

Rhode Island Univ., Kingston. Law of the Sea Inst.

W. T. Burke. Occasional Paper 25, (June 1975). 16p.

Descriptors: \*Law of the Sea, \*Governmental interrelations, \*Jurisdiction, \*Resources development, \*United Nations, Research and development, International waters, International law, Oceans, Continental shelf, Resource allocation, Water law, Economics, Economic impact, Foreign research, Exploitation, Exploration, Political aspects, Mining, Straits, Foreign countries.  
Identifiers: \*Coastal waters, Territorial seas(Jurisdiction), Coastal zone management, Economic zone, Coastal states, Seabed research, Ocean floor, High seas, Archipelagic waters.

This booklet suggests modifications to and explores the significance of the Informal Single Negotiating Text produced at the 1975 Geneva session of the Third Law of the Sea Conference. The Text is intended to serve as a basis for negotiation, with all participants free to propose amendments and stand on previous positions. Some of the more important Text provisions concerning the conduct of scientific ocean research are briefly examined. It is felt that all of the articles produced by the Committee Chairmen are unsatisfactory in terms of maintaining even a modest degree of freedom for research. In varying degree, each article permits restrictions on research by a coastal state or by the proposed International Authority which would be established to regulate seabed research beyond the limits of national jurisdiction. The issue is whether the consent of a coastal state ought to be required as a condition precedent to research in an economic zone or on the shelf. Certainly some mechanism should be established to assure that the research state or enterprise does in fact observe reasonable obligations to a coastal state, such as notification of projects, opportunity to participate, and access to data and specimens. (Reinders-Florida)  
W76-07825

#### GEOGRAPHY AND THE LOS DEBATE: GEOGRAPHICAL FACTORS AND THE PATTERNS OF ALIGNMENT,

Rhode Island Univ., Kingston. Law of the Sea Inst.

L. M. Alexander.

In: Perspectives on Ocean Policy, p. 317-330, U.S. Govt. Printing Office, Washington, D. C. 1974.

Descriptors: \*Law of the sea, \*International law, \*Water policy, Water resources, \*Foreign countries, Geographical regions, Negotiations, Islands, Jurisdiction, Commercial fishing, Fish management, Coasts, International commissions, Water resources development.

Identifiers: Economic zone, Land-locked countries, Geographically disadvantaged countries, Territorial seas.

Economic zone expansion has opened up several areas of potential international conflict. One involves the inequities of access to the ocean which could result to land-locked countries. For instance, it is yet undecided whether land-locked countries will be allowed access through coastal states or to share in zone resources, such as fish and minerals. These questions are of utmost importance to states having potential access to bountiful fishing grounds. To other land-locked countries these questions are less significant since the economic zone waters of their coastal neighbors have little resource potential. These states are interested in some type of international agreement which would provide meaningful compensation for states found to be 'geographically disadvantaged'. Prospects for such a concept seem unlikely, however, since disagreement abounds as to what factors should be considered in defining a state as geographically disadvantaged. Other potential problem areas include: the jurisdictional powers of foreign dominated islands lying within the territorial seas of other countries; the rights of distant-water fishing countries having large capital investments in fishing fleets operating in foreign water; and regional alignments of nations hoping to protect their own special interests. (See also W76-07330) (Hoffman-Florida)  
W76-07826

#### MAJOR ISSUES OF THE LAW OF THE SEA,

New Hampshire Univ., Durham.

1976, 229 p, 11 fig, 2 map, 13 tab, 1 chart, 6 ref. D. L. Larson, editor.

Descriptors: \*Continental shelf, \*Law of the sea, \*International commissions, \*International waters, \*Treaties, Foreign trade, Foreign waters, Baseline studies, Jurisdiction, Economic life, Economic justification, Marine fisheries, Marine geology, Mining, Navigation, Bays, Straits, Pollution abatement, Technology, Beds under water.  
Identifiers: \*Coastal waters, Contiguous zone, Navigation obstructions, Territorial seas(Jurisdiction).

The purpose of this book is to provide a concise summary and quick reference source for major sea law issues. Sea law is largely international law and the book uses the 'Informal Single Negotiating Text and Text on Settlement of Disputes of the Third United Nations Conference of the Law of the Sea' to focus current issues. Discussion is centered around thirteen major areas: baselines, territorial seas, contiguous zones, economic zones, the continental shelf, the deep sea bed, islands and archipelagoes, the high seas, fisheries, navigation, marine pollution, marine research, and technology transfer, and the settlement of disputes. Each chapter presents historical positions on the issue, the Single Negotiating Text position, opposing rational viewpoints and related issues not discussed in the Single Negotiating Text. Charts and tables illustrate each chapter. The introduction presents the history of the United Nations attempts to resolve the issues discussed in general. More specific international agreements and discussions appear in each chapter. (See W76-07828 through W76-07842) (Comer-Florida)

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

W76-07827

**INTRODUCTION,**  
New Hampshire Univ., Durham. Dept. of Political  
Science.  
D. L. Larson.  
In: Major Issues of the Law of the Sea, p. 1-14,  
Univ. of New Hampshire, Durham (1976).

Descriptors: \*Continental shelf, \*Law of the Sea,  
\*International commissions, \*International waters,  
\*Treaties, Foreign waters, Foreign trade,  
Baseline studies, Jurisdiction, Economic life,  
Economic justification, Marine fisheries, Marine  
geology, Mining, Navigation, Bays, Straits, Pollution  
abatement, Technology, Beds under water.  
Identifiers: \*Coastal waters, Contiguous zone,  
Navigation obstructions, Territorial  
seas(Jurisdiction).

Primary emphasis is placed on the importance and effect of the adoption of the informal Single Negotiating Text and Text on Settlement of Disputes by the Third United Nations Conference on the Law of the Seas. By mid-nineteenth century the open nature of the high seas was generally resolved. But from that time until today other major issues involving territorial waters, economic interests, marine pollution, exploration and control of sea beds have remained in dispute. Many of these issues were first generally identified during a League of Nations Conference in 1930. The issues are complex, however, and three United Nations Conferences have succeeded only in focusing the disputes so that resolution can be attempted. The Single Negotiating Text is the focusing document. The Text is informal and binds no nation but it presents concise statements of majority positions. A consensual resolution of at least some of the issues is expected this year. (See also W76-07827) (Comer-Florida)

W76-07828

**BASELINES,**  
Whittemore School of Business and Economics,  
Durham, N. H.  
J. A. Walz.  
In: Major Issues of the Law of the Sea, Chapter I,  
p. 15-27, Univ. of New Hampshire, Durham  
(1976).

Descriptors: \*Baseline studies, \*Coasts,  
\*International commissions, \*International law,  
Low water mark, Jurisdiction, Water law, Treaties,  
Coastal structures, Navigation, International  
Bound, Water Comm., Bays, Continental shelf.  
Identifiers: \*Territorial seas(Jurisdiction),  
\*Coastal waters, Coastal zone management.

Baseline determination is the starting point for all claims to areas of the oceans. Two historical methods of baseline determination exist; the headland to headland and the coastal parallel. A 1930 League of Nations Convention adopted the coastal parallel which is generally the method used today. Norway, however, still uses headland determination. The Informal Single Negotiating Text proposes coastal parallels for normal baselines, determined by the coastal low water line. Straight baselines are acceptable for deeply indented or island fringed coasts. Mixtures may be employed. Reefed islands have seaward edge of the reef lines. Bays, except historic bays, have baselines drawn as straight lines not longer than 24 nautical miles across the entrance. For baseline determination, permanent harborworks are part of the coast. Offshore installations are not. The text refers to historic waters and historic bays without providing adequate definition. A problem may result. Treatment of adjacent and opposite coastal state rights is inadequate. Baseline determination is not a highly disputed negotiation issue. (See also W76-07827) (Comer-Florida)

W76-07829

### THE TERRITORIAL SEA,

Whittemore School of Business and Economics,  
Durham, N. H.  
J. A. Walz.  
In: Major Issues of the Law of the Sea, Chapter II,  
p. 28-37, Univ. of New Hampshire, Durham  
(1976).

Descriptors: \*Marine fisheries, \*International law,  
\*International commissions, \*Treaties, Political  
constraints, Boundaries(Property), Coasts,  
Navigation, Economic justification, Jurisdiction,  
Bays, Straits, Foreign trade, Foreign waters,  
Foreign countries.

Identifiers: \*Territorial seas(Jurisdiction),  
\*Coastal waters, Contiguous zone, Navigation obstructions.

The territorial sea concept of coastal state jurisdiction over law of the sea issues within the area is well established. Current dissension exists, however, concerning the breadth of the territory. A majority of nations claim 12 mile limits or less but ten countries claim 200 or more nautical miles. All of the countries are in agreement, however, that coastal state sovereignty includes air, bed and subsoil sovereignty. To achieve agreement on territorial sea issues, the United Nations Law of the Sea Conference drafted Informal Single Negotiations Text. The text has proposed a twelve nautical mile maximum limit, with equidistant median line limits being set for opposite coastal states less than 24 miles apart. The larger territorial sea claims of developing nations present a roadblock to the acceptance of this text. Consequently, a package deal is proposed including economic zones and special fishery rights along with 12 nautical mile limits. The package is intended to improve agreement prospects. (See also W76-07827) (Comer-Florida)

W76-07830

### THE CONTIGUOUS ZONE,

Whittemore School of Business and Economics,  
Durham, N. H.  
J. A. Walz.

In: Major Issues of the Law of the Sea, Chapter  
III, p. 38-44, Univ. of New Hampshire, Durham  
(1976).

Descriptors: \*International law, \*International  
commissions, \*Treaties, \*Marine fisheries,  
\*Foreign waters, Foreign trade, Jurisdiction,  
Economic justification, Coasts, Navigation, Political  
constraints, Continental shelf, Foreign countries,  
United Nations.

Identifiers: Contiguous zone, Coastal waters, Territorial  
seas(Jurisdiction), Navigation obstructions.

The contiguous zone is an area outside the territorial sea over which a nation may exercise rights less than sovereignty. The concept predates territorial seas but lost recognition with the establishment of sovereign sea areas. The contiguous zone has regained popularity in lieu of larger territorial seas. Unlike territorial seas, contiguous zones are high seas areas with limited shipping interference. Coastal state seizure of vessels is allowed only under the hot pursuit doctrine. The Informal Single Negotiating Text proposes a contiguous zone extending not more than 24 nautical miles from the baseline. The coastal state may use the zone to prevent or punish violations of customs, fiscal, immigration and sanitation laws within the territorial sea. Civil and criminal jurisdiction is limited to criminal activity against the coastal state or threatening territorial seas, narcotics suppression or requests for assistance. The contiguous zone may lose importance if the economic zone of the Text is adopted. In any event, the principles associated with the contiguous zone may be applied to the economic zone. (See also W76-07827) (Comer-Florida)

W76-07831

### THE ECONOMIC ZONE,

Whittemore School of Business and Economics,  
Durham, N. H.  
R. W. Pabst.

In: Major Issues of the Law of the Sea, Chapter  
IV, p. 45-51, Univ. of New Hampshire, Durham  
(1976).

Descriptors: \*International law, \*International  
commissions, \*Treaties, \*Marine fisheries, Mining,  
Coasts, Navigation, Boundaries(Property), Economic  
justification, Eco-systems, Ecology, Fish conservation,  
International waters, Foreign trade, Foreign waters, Continental shelf.

Identifiers: Coastal waters, Contiguous zone, Territorial  
seas(Jurisdiction), Navigation obstructions.

The economic zone is an area beyond the territorial sea with coastal state sovereignty over natural resources. The concept is the result of pressure from developing countries for greater participation in sea resource development. The 1958 Convention on the Continental Shelf recognized coastal sovereignty over an indefinite extent of shelf seabed and subsoil. The Informal Single Negotiating Text proposes expansion of sovereignty to include fisheries and a 200 nautical mile limit. Under the Text coastal states have sovereignty rights over all natural resources of the sea bed, the subsoil and the superadjacent waters. This sovereignty does not extend to the area itself, however, and the extent of sovereignty is a disputed issue. If sovereignty over the area is adopted the result would be an extended territorial sea where navigation rights could be seriously impaired. Rights of opposite coastal states is also an unresolved issue. The text contemplates future treaty arrangements to solve the above issues. (See also W76-07827) (Comer-Florida)

W76-07832

### CHAPTER V: THE CONTINENTAL SHELF,

New Hampshire Univ., Durham. Law of the Sea  
Intern Program.

D. Campbell III.

In: Major Issues of the Law of the Sea, Chapter V  
p. 52-66, Univ. of New Hampshire, Durham  
(1976).

Descriptors: \*Continental shelf, \*International  
law, \*International commissions, \*Treaties,  
\*Mining, Coastal structures, Coasts, Foreign  
waters, International waters, Marine geology,  
Beds under water, Boundaries(Property), Baseline  
studies, Navigation, Foreign trade, Technology,  
Pollution abatement.

Identifiers: \*Coastal waters, Contiguous zone,  
Territorial seas(Jurisdiction), Navigation obstructions,  
Coastal zone management.

Claims to continental shelf sovereignty are relatively recent dating from 1944. By 1950 more than 30 nations had made claims. Increasing technology and energy needs have caused growing interest in shelf resources. The 1958 Convention recognized claims to areas of ocean depth of 200 meters or to a point at which exploitation is not admitted. The Informal Single Negotiating Text links shelf sovereignty to the economic zone and gives coastal states sovereignty rights in subsoil and seabed beneath the 200 nautical mile zone. As with the economic zone the extent of continental shelf sovereignty is important. Sovereignty over resources but not over the area allows coastal state resource protection without impeding navigation rights of other nations. The Text also addresses the unresolved issue concerning the rights of opposite coastal states. Exploitation is allowed beyond the continental shelf limit but details of inspection of installations and payment for rights are left for future negotiation. (See also W76-07827) (Comer-Florida)

W76-07833

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

**THE DEEP SEA-BED,**  
Whitemore School of Business and Economics,  
Durham, N.H.  
J. A. Walz.

In: Major Issues of the Law of the Sea, Chapter VI p. 67-83, Univ. of New Hampshire, Durham (1976)

Descriptors: \*International waters, \*International law, \*Mining, \*International commissions, Technology, Marine geology, Investment, Jurisdiction, Foreign waters, Ecology, Pollution abatement, Mineralogy, Oil, Copper, Zinc, United Nations.

Identifiers: \*Public trust doctrine, Navigation obstructions, Coastal zone management.

Treatment of the deep sea bed is the most controversial issue facing the Third Conference. The 1958 Convention ignored the issue because of lack of technology and interest. The interest has grown rapidly, however, and eight entities are currently waiting to mine seabed resources. Although the claim is not generally recognized, one company has already claimed certain Pacific Ocean floor areas. The United States Senate is considering a bill allowing mining claims despite lack of international agreement. The Third Conference received two negotiation proposals. The 'Pinto Text' limits international authority over mining to resource activity. The United States favors the 'Pinto Text'. The 'Engo Text' is the Informal Single Negotiating Text proposal. The 'Engo Text' provides for international control over all seabed activities. Major areas of controversy include the extent of international authority, the right of national mining by states, and the composition and organization of the international seabed authority. Near agreement is not expected and threats of unilateral action cause concern. (See also W76-07827) (Comer-Florida)  
W76-07834

**FISHERIES,**  
Whitemore School of Business and Economics,  
Durham, N.H.  
R. W. Pabst.

In: Major Issues of the Law of the Sea, Chapter VII p. 84-106, Univ. of New Hampshire, Durham (1976).

Descriptors: \*Marine fisheries, \*International law, \*Anadromous fish, \*Catadromous fish, \*International commissions, Conservation, Marine fish, Navigation, Foreign waters, Foreign trade, Migration patterns, Fish, Natural resources, Treaties, Economic impact, Economic justification, Ecosystems, United Nations.

Identifiers: \*Coastal waters, Territorial seas(Jurisdiction), Mercury pollution, Coastal zone management.

The long accepted concept of free access to ocean fisheries is based upon a theory of inexhaustible resources. Estimates today, however consider that the maximum potential yield from traditional fisheries will be reached by the year 2000. Consequently, conservation of resources is a major concern. Fishing rights treaties data from the eighteenth century but not until after World War II was any concern expressed for the depletion of coastal area fish. In 1958, the Geneva Conference recognized conservation needs and provided arbitration for disputes; but it granted coastal states only preferential rights. The modern trend, despite the objections of fishing interests, is toward exclusive control by the coastal states. This trend is illustrated by the Informal Single Negotiating Text which adopts the sovereignty over resources approach. Under this approach, coastal states can control and are responsible for conservation within their jurisdictional area, with special provisions being made for migratory anadromous and catadromous species. Although differing positions continue on the enforcement by flagship states or coastal states, the text grants coastal jurisdiction. Despite this text, controversy and discussion will

continue to exist concerning contiguous zone jurisdiction and the responsibility and answerability of coastal states for fish conservation. (See also W76-07827) (Comer-Florida)  
W76-07835

**MARINE POLLUTION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
D. Campbell, III.

In: Major Issues of the Law of the Sea, Chapter VIII, p. 107-124, University of New Hampshire, Durham (1976).

Descriptors: \*Pollution abatement, \*International law, \*International commissions, \*Treaties, \*Oil, Spills, Oil pollution, Industrial wastes, Navigation, Marine fisheries, Ecology, Ecosystems, Mining, Jurisdiction, United Nations, , Foreign countries, Ships.

Identifiers: \*Public trust doctrine, \*Mercury pollution, Coastal waters, Coastal zone management.

Because the 1954 Convention considered only vessel-source oil pollution, and because enforcement was exclusively the flag state's, this first attempt to control international marine pollution was only limitedly effective. The 1973 Convention (IMCO) should be more effective since it is applicable to numerous harmful substances, not just oil. Several problems of international pollution control remain undecided, however. For example, exclusive flag state jurisdiction continues in IMCO, thus reducing effective enforcement. Furthermore, land based pollution, representing 50 to 90% of marine pollution, is still unregulated. The 1975 Informal Single Negotiating Text is attempting to address some of these problems and is proposing: to regulate land and vessel source pollution; to provide enforcement by flag, coastal and port states; to allow coastal states to establish standards within zones of control; to establish a five member committee to settle disputes. All of the proposals are controversial, with ambiguity and conflicting interests posing serious problems. The major conflicts are between the developing and developed countries, with the developing nations being less interested in pollution than in prosperity. In addition, the United States and some other developed maritime nations support exclusive flag state control, a concept which is generally opposed by developing nations. Another controversy, with special opposition by the United States, is the open ended provision that coastal states may apply to the committee for protection of 'special areas'. Because of these conflicts a strong agreement is doubtful. (See also W76-07827) (Comer-Florida)  
W76-07836

**NAVIGATION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
D. Campbell, III.

In: Major Issues of the Law of the Sea, Chapter IX, p. 125-139, Univ. of New Hampshire, Durham (1976).

Descriptors: \*Navigation, \*International law, \*International commissions, \*Treaties, \*Foreign waters, Foreign trade, Straits, Bays, Jurisdiction, Law of the sea, Continental shelf, Marine fisheries, Pollution abatement, United Nations, Oceans.

Identifiers: \*Coastal waters, Territorial seas(Jurisdiction), Navigation obstructions.

Navigation is a traditional freedom of the seas and includes the principles of neutrality, flag state control of vessels, rights of innocent passage through territorial seas, and absolute freedom of transit through straits. The 1958 Convention codified many navigational concepts but mixed innocent passage rights with freedom of transit. Whether distinction of the principles should be made is one of the issues before the 1975 Conference. Archipelagic rights, economic zone control and

pollution control may all impede navigation and a balance must be reached. The Informal Single Negotiating Text sets standards for determining if passage in territorial seas is innocent and allows coastal state prevention if it is not. Coastal states may also adopt programs to insure navigational efficiency and safety, and may control fishing, conserve resources and prevent pollution in territorial waters. The text also contains the following provisions: unimpeded transit shall govern straits subject to pollution, safety and fishing laws; freedom of navigation shall exist in economic zones; and landlocked states shall have free access to the sea. Despite these provisions, some coastal states prefer innocent passage through straits while others prefer coastal sovereignty over economic zones. Consequently, numerous compromises will have to be made before a strong agreement can be reached. (See also W76-07827) (Comer-Florida)  
W76-07837

**ISLANDS AND ARCHIPELAGOES,**  
Whitemore School of Business and Economics, Durham, N.H.  
R. W. Pabst.

In: Major Issues of the Law of the Sea, Chapter X, p. 140-158, Univ. of New Hampshire, Durham (1976).

Descriptors: \*Coasts, \*Baseline studies, \*International commissions, \*Law of the seas, \*Navigation, International law, Jurisdiction, Continental shelf, Marine fisheries, Straits, Foreign trade, Foreign waters, Treaties, United Nations.

Identifiers: \*Coastal waters, Territorial seas(Jurisdiction), \*Navigation obstructions.

The major international concern with archipelagoes arises because use of straight baselines may impede navigation. Archipelagoes were a concern of the 1930 Hague Conference but no agreements were reached. From 1930 to present the major question of archipelagoes has been baseline and internal waters determination. The Informal Single Negotiating Text defines archipelagoes as a group of island with all natural features forming a geographic, economic and political entity. An archipelagic state (AS) is one or more archipelagoes and other islands if necessary. An AS may draw straight baselines joining its outermost points if the ratio of water area to land is between 1 to 1 and 9 to 1. Once this baseline is determined, the AS sovereignty extends to all waters enclosed. Since 'archipelagic waters' are not necessarily internal waters, AS's may not suspend sealane passage in contravention of innocent passage rights. An AS may establish sealanes but may not suspend sealane passage. Safety, pollution control and fishing laws are allowable. The Text proposals will not settle disputes such as the current Greek-Turkish dispute over Aegean seabeds. It will also not settle other areas of difficulty. Indonesia, for instance, claims the Straits of Malacca as territorial - open to commercial navigation but not to warships. Major maritime powers oppose this position. Despite these unsolved problems, the text should have beneficial effects. (See also W76-07827) (Comer-Florida)  
W76-07838

**MARINE SCIENTIFIC RESEARCH AND THE TRANSFER OF TECHNOLOGY,**  
Whitemore School of Business and Economics, Durham, N.H.  
J. A. Walz.

In: Major Issues of the Law of the Sea, Chapter XI, p. 159-174, Univ. of New Hampshire, Durham, (1976).

Descriptors: \*Coasts, Technology, \*International law, \*International commissions, \*Law of the seas, Mining, Marine geology, Marine biology, Scientific personnel, Jurisdiction, Communication, Foreign countries, United Nations, Research and development.

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

Identifiers: \*Public trust doctrine, Licenses, Navigation obstructions, Congressional hearings, \*Technology transfer.

Present international law recognizes coastal state control of continental shelf and territorial sea research and flag state control of high seas research. The major issue involving marine research before the 1975 Geneva Conference is whether coastal state consent is required for research in controlled zones. Coastal states have been reluctant to grant consent in the past for two main reasons: protection of resources and lack of technology transfer. The Informal Single Negotiating Text attempts a compromise. Coastal state consent will be required for research connected with living and non-living resources while consent will not be required for non-resource related research. Coastal states will also have the exclusive right to conduct research in territorial seas. In addition, economic zone and continental shelf research must respect the rights of coastal states. Furthermore, the coastal states will have a participation right and access to results. The Text recognizes that high seas research is a right of all states but it requires that the Sea Bed Authority be informed of the project and that the results be published. This technology transfer will be further promoted through training and documentation programs. Any disputes which arise under the Text will be settled by a special committee of experts. The compromise Text will probably be adopted since major problems are administrative rather than substantive. (See also W76-07827) (Comer-Florida)

W76-07839

**SETTLEMENT OF DISPUTES,**  
Whittemore School of Business and Economics,  
Durham, N.H.

J. A. Walz, and D. Campbell, III.

In: Major Issues of the Law of the Sea, Chapter XII, p. 175-189, Univ. of New Hampshire, Durham (1976).

Descriptors: \*Continental shelf, \*International commissions, \*International law, \*Jurisdiction, \*Law of the seas, International waters, Mining, Marine fisheries, Navigation, Coasts, Boundaries(Property), Marine geology, Pollution abatement, Ships.

A world wide treaty on law of the sea issues requires some form of dispute settlement procedures for three major reasons: the necessary avoidance of economic and political pressure; the need for uniformity of Convention interpretation and application; and the assurance to nations that their interests are equally protected. Historically, dispute settlement has taken two forms, terms dictated by a third party as in arbitration or judicial settlement, and terms agreed upon by the parties through mediation or conciliation. The Informal Single Negotiating Text adopts three procedures substantially identical to those incorporated into the 1930 Hague Conference: (1) arbitration, (2) conciliation and (3) fact finding and decisions of a tribunal. All contracting states must choose at least one method. The selection of members and procedures proposed attempt to encompass as many aspects of settlement as possible. An important omitted issue is the time within which rapid decision making must be effected in cases of vessel delay. Another area of dispute is dispute settlement in economic zone or continental shelf disagreements. (See also W76-07827) (Comer-Florida)

W76-07840

**THE HIGH SEAS AND SELECTED SPECIAL ISSUES,**

New Hampshire Univ., Durham. Law of the Sea Intern Program.

D. Campbell III.

In: Major Issues of the Law of the Sea, Chapter XIII, p. 190-213, Univ. of New Hampshire, Durham (1976).

Descriptors: \*International waters, \*International commissions, \*Continental shelf, \*International law, \*Navigation, Foreign waters foreign trade, Jurisdiction, Straits, Pollution abatement, Marine geology, Marine fisheries, Law of the sea, Coasts, United Nations.

Identifiers: \*Public trust doctrine, Navigation obstructions.

The high sea areas continue to contract as concepts of economic zones, continental shelves and archipelagic waters develop. The rights and freedoms codified in the 1958 Convention still exist in the 1975 Single Informal Negotiating Text although the area covered is less. These include the following: freedom of navigation; freedom of overflight; freedom to lay submarine cables and pipelines; freedom to construct installations permitted by international law; freedom of fishing subject to other Text provisions; and freedom of scientific research subject to Text restrictions. Flag state vessel jurisdiction continues on high seas, but the right of hot pursuit is modified by economic zone considerations. The 'high seas' is defined in the Text as all parts of the sea not in the economic, territorial, internal waters or archipelagic zones. Other issues raised by the Text but not totally resolved are enclosed and semi-enclosed seas, national security aspects of sea law, conservation measures for resources, and the problems of land locked states. The land locked states controversy concerns the degree to which such states have a right to free access to the high seas and to a sharing of the sea resources of adjacent coastal states. Details of this and other issues must be worked out through bilateral and regional agreements. (See also W76-07827) (Comer-Florida)

W76-07841

**CONCLUSION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.

D. Campbell III, D. L. Larson, T. W. Pabst, and J. A. Walz.

In: Major Issues of the Law of the Sea, p 214-223, Univ. of New Hampshire, Durham (1976).

Descriptors: \*Continental shelf, \*Law of the sea, \*International commissions, \*International law, \*Treaties, Jurisdiction, Baseline studies, Coasts, Marine fisheries, Navigation, Mining, Marine geology, Straits, Pollution abatement, Beds under water, United Nations, Water pollution control.

Identifiers: Coastal waters, Contiguous zone, Navigation obstructions, Territorial seas(Jurisdiction), Public trust doctrine.

The Third United Nations Conference on the Law of the Sea convened in response to pressures arising and reaching acute stages within the past few years. The Conference is the largest ever convened and the variety of interests represented has had repercussions far beyond mere codification of existing law. The complexity of issues faced by the Conference is mirrored in the pressures being exerted within the United States. Mining companies, for instance, are directly in conflict with fisheries while conservationists oppose both interests. The United States has formulated a policy to use every reasonable means to aid developing countries; however, the U. S. is concerned about the possibility of navigation rights interferences and stringent sea bed authority. The main thrust of U. S. policy is stability and order with corresponding national freedom. If the Third Conference cannot arrive at agreement, no disastrous results will follow; but the current status of sea law, which is uneven and ambiguous, will continue. With the problems facing the world today, ad hoc problem solving is inefficient. There is a probability of adoption of several proposed conventions even if all issues are not resolved. (See also W76-07827) (Comer-Florida)

W76-07842

**PREPARATION OF WATER QUALITY MANAGEMENT PLANS.**  
Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07843

**ORE MINING AND DRESSING POINT SOURCES CATEGORY, INTERIM FINAL RULES.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07844

**ORE MINING AND DRESSING POINT SOURCE CATEGORY.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07845

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM AND STATE PROGRAM ELEMENTS NECESSARY FOR PARTICIPATION CONCENTRATED ANIMAL FEEDING OPERATIONS.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07846

**COAL MINING POINT SOURCE CATEGORY: APPLICATION OF EFFLUENT LIMITATIONS GUIDELINES FOR EXISTING SOURCES TO PRETREATMENT STANDARDS FOR INCOMPATIBLE POLLUTANTS.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07847

**COAL MINING POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07848

**MINERAL MINING AND PROCESSING POINT SOURCE CATEGORY INTERIM FINAL RULEMAKING.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07849

**GRAIN MILLS POINT SOURCE CATEGORY: PROPOSED PRETREATMENT STANDARDS FOR NEW SOURCES.**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07850

**INK FORMULATING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS,**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07851

**NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM,**

Environmental Protection Agency, Washington, D.C.  
For primary bibliographic entry see Field 5G.  
W76-07852

## Field 6—WATER RESOURCES PLANNING

### Group 6E—Water Law and Institutions

**NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY, EFFLUENT LIMITATIONS AND GUIDELINES,** Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07853

**NONFERROUS METALS MANUFACTURING POINT SOURCE CATEGORY,** Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07854

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY, INTERIM FINAL RULE MAKING,** Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07855

**IRON AND STEEL MANUFACTURING POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.**

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07856

**CANNED AND PRESERVED FRUITS AND VEGETABLES PROCESSING INDUSTRY POINT SOURCE CATEGORY PROPOSED EFFLUENT GUIDELINES AND STANDARDS.**

Environmental Protection Agency, Washington, D.C.

For primary bibliographic entry see Field 5G.  
W76-07857

**FRAMEWORK AND RIVER BASIN STUDY PROGRAMS, LEVEL A AND LEVEL B STUDIES.**

Corps of Engineers, Washington, D.C.  
Federal Register, Vol. 40, No. 145, p. 31718-22, July 28, 1975. 5 p. 1 tab.

Descriptors: \*U.S. Water Resources Council, \*Federal Water Pollution Control Act, \*Planning, \*Water resources development, Water supply development, Water resources research, Regional analysis, Regional development, Future planning(Projected), Water management(Applied), Coordination, Federal government.

Identifiers: Administrative regulations.

This regulation provides general guidelines for Corps of Engineers' participation in multi-agency studies of Level A scope (Framework and Assessment) and Level B scope (Regional or River Basin) as defined by the Water Resources Council (WRC). There are three general levels of studies in the Federal water planning programs: Level A Assessments and Framework, Level B Regional or River Basin Studies, and Level C Implementation Studies. Level A, the broadest, is an analysis of water and related land problems in major regions of the United States. Level B studies are made at the regional level, and encompass problems of a complex, inter-disciplinary nature, involving judgmental planning with no new data collection and multi-agency planning under the guidance of the WRC. The Corps of Engineers' role in Level A and Level B studies will usually be that of a participant, but in some cases, the coordinating field entity may request the Corps of Engineers to take charge. Where there is no coordinating field entity the Corps of Engineers may be directly named as the study sponsor by the WRC. (Edenfield-Florida)  
W76-07858

#### NAVIGATION OF RESTRICTED AREAS.

Corps of Engineers, Washington, D.C.  
Federal Register, Vol. 40, No. 138, p. 30118-19, July 17, 1975. 2p.

Descriptors: \*South Carolina, \*Navigable waters, \*Rivers and Harbors Act, \*River regulation, \*Navigation, Rivers, Legislation, Planning, Tributaries, Federal jurisdiction, Federal government, Boating regulations, Administrative agencies, Management, Operations, Water policy, Water rights, Control, Boundaries(Property).

Identifiers: Water rights(Non-riparians), Administrative regulations, Restricted areas.

Notice is given of tentative regulations proposed by the Secretary of the Army pursuant to Section 7 of the River and Harbor Act of 1917. The proposed regulations govern the use and navigation of restricted areas in the Cooper River and its tributaries at Charleston, South Carolina. It is proposed to amend the present regulations with respect only to the extension of boundaries of the restricted areas. Prior to adoption, consideration will be given to any comments, suggestions or objections thereto which are submitted. (Reinders-Florida)  
W76-07859

#### OCEAN DUMPING.

Jt. Hearings -- Sub. Comm. on Fisheries and Wildlife Conservation and the Environment and Sub. Comm. on Oceanography -- Comm. on Merchant Marine and Fisheries, U.S.H.R., April 24, 25, 1975, p. 1-171.

Descriptors: \*Waste disposal, \*Waste dumps, \*Water pollution control, \*Oceans, \*Water quality, Water pollution effects, Pollution abatement, Radioactive waste disposal, Municipal wastes, Biological warfare, Chemical warfare, Federal jurisdiction, Administrative agencies, Federal reservations, Legislation, Great Lakes Region, Permits. Identifiers: Administrative regulations, Licenses, \*Ocean dumping, Sanctuaries, Coastal waters, Marine Protection, Research, and Sanctuaries Act of 1972, Warfare wastes.

In April, 1975, hearings were conducted before two Senate subcommittees to consider legislation that would extend certain appropriation authorization under the Marine Protection, Research, and Sanctuaries Act of 1972. This Act is composed of three titles: Title I places an outright ban on the dumping of high-level radioactive wastes and all biological, chemical, and radiological warfare agents into the nation's waters. Also, it prohibits the dumping into these waters of all other waste material, except as authorized by permit issued by the Environmental Protection Agency (EPA) or the Secretary of the Army. Title II requires the Secretary of Commerce to carry out comprehensive and continuing programs of research on the effects of the dumping of waste material into the nation's oceans, brackish waters, and the Great Lakes. Title III authorizes the designation of certain areas in these waters as marine sanctuaries when deemed necessary for preservation or restoration of such areas for their conservation, recreational, ecological or aesthetic values. Included in the hearing report are materials provided by the Coast Guard, Corps of Engineers, EPA, National Wildlife Federation and the National Oceanic and Atmospheric Administration. (Reinders-Florida)  
W76-07860

#### STATUS REPORT ON LAW OF THE SEA CONFERENCE.

Hearings---Sub Comm on Minerals, Materials and Fuels---Comm on Interior and Insular Affairs, U.S. Senate, October 29, 1975, p 1423-1592.

Descriptors: \*United Nations, \*Commercial fishing, \*Manganese, \*Mining, \*Law of the Sea, Exploration, Fishing, Fish, Marine fisheries, Metals, Copper, Nickel, Cobalt, Navigation, Continental

shel, Oil, Resources, Oceans, Treaties, International law, United States.

Identifiers: \*Deep seabed mining, Territorial seas(Jurisdiction), Marine resources, Coastal waters, Coastal fisheries, Fishing zone.

Concern over depletion of fish stocks in the United States' off-shore waters caused the introduction of legislation in Congress which would allow the United States to order a reduction of effort by foreign fishermen. This in turn led to concern by the United States delegation to the United Nations that such unilateral action would impede negotiations at the United Nations Law of the Sea Conference, which hopefully will produce an international body of law regulating all use of the seas. U.S. representatives feel that the Conference may reach an agreement relative to off-shore fishing regulation in the foreseeable future. However, it appears that no agreement will be reached until there is some consensus on the problem of deep-seabed mining rights. Many of the smaller member nations, which constitute majority of the votes, are demanding regulations such as price and production controls and disproportionate profit sharing by nations not participating in the effort of extracting the deep-sea minerals. The United States does not consider these proposals to be reasonable. This status report, the fourth in a series, includes position papers by concerned organizations and individuals. (Sloan-Florida)  
W76-07861

#### DEVELOPMENT OF NEW REGULATIONS BY THE CORPS OF ENGINEERS, IMPLEMENTING SECTION 404 OF THE FEDERAL WATER POLLUTION CONTROL ACT CONCERNING PERMITS FOR DISPOSAL OF DREDGE OR FILL MATERIAL.

Hearings---Sub. Comm. on Water Resources---Comm. on Public Works and Transportation, USHR, July 15, 16, 22, 1975. p. 1-292.

Descriptors: \*Federal jurisdiction, \*Federal Water Pollution Control Act, \*Dredging, \*Water quality control, \*Federal government, Water pollution control, Administrative agencies, Governmental interrelations, Environmental effects, Navigable waters, Tributaries, Tidal waters, Management, Decision making, Planning, Permits. Identifiers: Administrative regulations, Coastal waters, FWPCA Amendments of 1972, Fill permits, Licenses.

Hearings were held to receive a status report on the development of proposed alternative regulations by the Corps of Engineers to implement section 404 of the Federal Water Pollution Control Act. This section assigns the regulation of the discharge of dredged materials in navigable waters to the Secretary of the Army acting through the Chief of Engineers and with guidance from the Administrator of the Environmental Protection Agency (EPA). The Corps' jurisdiction was thought to extend only to those water areas within the classical definition of navigable waters, namely, those waters subject to the ebb and flow of the tide or that may be susceptible of use for interstate or foreign commerce. On March 27, 1975, however, the District Court for the District of Columbia ruled that prior regulations did not recognize the full regulatory mandate of Section 404. Accordingly, two of the present alternatives propose a limited expansion of the term 'navigable waters' to include their primary tributaries and all coastal waters supporting salt water vegetation. The remaining two alternatives propose broad definitions of the term. Proposed decision making guidelines developed by the EPA were published concurrently with these four proposed alternatives. (Reinders-Florida)  
W76-07862

#### TWO -HUNDRED -MILE FISHING ZONE.

Hearing---Sub Comm on Oceans and International Environment---Comm on For Relations, US Senate, October 31, 1975, p 1-443.

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

**Descriptors:** \*United States, \*Continental shelf, \*International law, \*Law of the Sea, \*Fish conservation, Fisheries, Anadromous fish, Fish management, Fishing, Commercial fishing, Conferences, Federal government, Federal jurisdiction, Foreign waters, Governments, Legal aspects, Legislation, Foreign countries, Foreign trade.  
**Identifiers:** \*Fishery conservation zone, Law of the Sea Conference.

Proposed Bill S. 961 seeks to restore and maintain the offshore fisheries of the United States by granting the United States exclusive fishery management jurisdiction extending two hundred nautical miles over fishery resources found on the Continental Shelf. The Bill is a temporary emergency measure, to be effective July 1, 1976, resulting from the failure of first and second sessions of the United Nations Law of the Sea Conference to reach agreement establishing an orderly regime for world fishing resources. It will cease effectiveness once the Law of the Sea treaty has been signed. The opposition argues other nations will unilaterally extend and make similar claims thereby frustrating negotiations for upcoming Conferences; and that violation of international law will occur, producing conflict with foreign nations, especially the Soviet Union and Japan. However, other nations have already exceeded the current three mile legal maximum. In light of the extreme need for protective legislation the Bill should be passed. In addition the United States leadership in extending the three mile limit will provide encouragement and trigger acceptance of the two hundred mile limit at the next Law of the Sea Conference. (Hadoulias-Florida)  
W76-07863

**TO AMEND THE LAND AND WATER CONSERVATION FUND ACT OF 1965 AND TO AMEND THE HISTORIC PRESERVATION ACT OF 1966.**  
Hearings—Sub Comm on Nat Parks and Recreation—Comm on Interior and Insular Affairs, US HR, July 28, 1975, p. 1-149.

**Descriptors:** \*Recreational facilities, \*Leases, \*Recreation demand, \*Economic feasibility, \*Oil industry, United States, Resources, Recreation, Conservation, Oil, Land use, Resources development, Resource allocation, Land resources, National parks, Social needs, Water demand, Land management, Legislation, Water resources development.  
**Identifiers:** Land and Water Conservation Fund, Offshore oil and gas.

The Land and Water Conservation Fund draws most of its income from Federal receipts from Outer Continental Shelf Oil and gas leasing. The fund is then used to acquire Federal recreation lands and to make matching grants to state and local governments for the same purpose. State and local needs for such lands are increasing, and the proposed amendments would increase the amounts to be made available for matching funds while establishing a historic preservation fund drawing its income from the same leasing receipts. Gross receipts from Outer Continental Shelf leases were approximately two-and-a-half billion dollars in Fiscal Year 1975 and were expected to be approximately 8 billion in Fiscal Year 1976. Contained in the record are letters and testimony in opposition to the amendments in their present form, including statements of representatives of the Secretaries of Agriculture and Interior on behalf of the Administration moratorium on new federal spending programs. The record also contains favorable testimony from members of Congress, state agencies, and organizations such as the Sierra Club and the National Wildlife Federation. (Sloan-Florida)  
W76-07864

**GEOTHERMAL ENERGY DEVELOPMENT.**  
Hearings—Sub Comm on Energy Research and Water Resources Comm on Intern and Insular Affairs, US Senate, October 17, 1975, p 1-515.

**Descriptors:** \*Idaho, \*Geothermal studies, \*Government finance, \*Research and development, \*Energy, Electricity, Economic impact, Engineering, Engineering structures, Federal government, Geographic regions, Government supports, Governmental interrelations, Research equipment, Research facilities, Research priorities, Leases.  
**Identifiers:** \*Raft River Geothermal Development Co-operative, Hot water systems, \*Geothermal leasing, Geothermal Steam Act, Development and Demonstration Act of 1974, Alternative energy sources.

Hearings have been held before the Subcommittee on Energy Research and Water Resources to receive testimony on the progress of the Raft River Geothermal Development Co-operative in the state of Idaho. A promising hot water system has been discovered utilizing hot water of 300 degrees F. in a binary Magmax-type powerplant. Geothermal heat would be applied to a secondary fluid, heated then expanded, inexpensively generating electricity. Energy Research and Development Administration (ERDA) funding for construction of a ten megawatt pilot plant would supply Raft River area's electrical needs while also providing the Nation with valuable research in geothermal energy potential. Funds have been supplied by state and local agencies and private lands have been leased by the Co-operative for geothermal development rights. ERDA's delay in funding results from deliberations concerning construction of a fifty megawatt commercial demonstrative plant for which the same Raft River site is a promising location. No guarantees that Raft River will be granted the fifty megawatt demonstration project in lieu of the proposed ten megawatt pilot plant have been made and Raft River needs funds now. Possible solutions include revision of the Geothermal License Act requiring leasing of geothermal land for preliminary explorations, and the granting of leasing rights to those first filing or first locating commercially valuable geothermal resources. (Hadoulias-Florida)  
W76-07865

#### WATERSHED PROJECTS.

Hearings—Sub. Comm. on Conservation and Credit—Comm. on Agriculture. U. S. House of Representatives, June 23 and October 28, 1975, p. 1-69.

**Descriptors:** \*Agricultural watersheds, \*Environmental effects, \*Cost-benefit analysis, \*Flood control, \*Federal project policy, Watersheds, Agricultural engineering, Water storage, Flood protection, Drainage engineering, Drainage effects, Drainage programs, Recreation, Diversion structures, Cost-benefit ratio, Land management, Grading, Surface drainage, Water conservation, Watershed management, Watershed Protection and Flood Prev. Act, Federal government.  
**Identifiers:** Environmental impact statements.

The Subcommittee on Conservation and Credit held approval hearings pertaining to twelve variously located watershed projects in June and October of 1975. Funding was considered for the following projects: Bayou Bonne Idee, La.; Bayou Plaquemine Brule, La.; East Franklin, La.; First Capital, Wis.; Flar Rock Creek, Ark.; Kickapoo Creek, Tex.; Kinder, La.; Newman Lake, Wash.; Norman-Polk, Minn.; Spring Canyon, Wyo.; Stoney Creek, N.C.; and Upper Brushy Creek, Ala. Information contained in the report includes project size and location, tributary involved, sponsors, watershed land use, number and size of farms served, and general project purposes. These projects are designed to provide watershed protection, flood prevention, drainage, recreation, and fish and wildlife improvements. Suggested measures range from soil conservation practices on farms, ranches, and woodlands, to structural techniques for storage, diversion, and retardation. Each project report includes an Environmental

Impact Statement and a cost-benefit analysis consisting of a project costs and annual benefits breakdown. (Reinders-Florida)  
W76-07866

#### DREDGING ON THE MISSOURI RIVER OXBOW LAKES.

Hearings—Sub. Comm. on Water Resources—Comm. on Public Works, U. S. Senate, September 29, 1975, p. 1-220.

**Descriptors:** \*Missouri River, \*Iowa, \*Dredging, \*Oxbow Lakes, \*Rehabilitation, Federal government, Cost-benefit analysis, Conservation, Benefits, Capital costs, Cost analysis, Costs, Recreation, Recreation demand, Recreation facilities, Wildlife conservation, Cost sharing.  
**Identifiers:** \*Lake Manawa(Iowa).

The purpose of proposed bill S1799 is to authorize the Secretary of the Army to carry out dredging and related activities and shoreline stabilization work on the Missouri River, particularly upon Lake Manawa in the State of Iowa for the purpose of implementing state and public general improvement programs for recreational purposes. The Bill, if enacted, would require non-Federal interests to pay 50 percent of the costs, and that not less than 20 percent of affected lakes be made available for use by the general public. The Department of the Army recommended against passage of S1799 arguing the lack of a Federal study and the failure of a similar rehabilitation project at McCook Lake. The Hearings demonstrate the need for dredging, and utilize cost-benefit analysis to demonstrate the favorable effect of the renovation program within the region. Major parties interested in the Lake Manawa Dredging Project, including representatives of the U. S. Army Corps of Engineers and the Iowa Conservation Commission, met for discussion of S1799 on October 21, 1975 and resolved that the Interstate Commerce Commission and the Iowa Legislature favor the proposed cost-sharing approach, and that the Corps under Congressional direction participate in the dredging. (Hadoulias-Florida)  
W76-07867

#### NATIONAL FLOOD INSURANCE ACT—1975.

Hearings—Sub. Comm. on Housing and Urban Affairs—Comm. on Banking, Housing and Urban Affairs, U. S. Senate, June 13, 23, 1975, p. 1-150.

**Descriptors:** \*Local government, \*Flood plain insurance, \*Federal government, \*Legislation, \*Flood plain zoning, Insurance, Floods, Flood plains, Regulation, Non-structural alternatives, Flood protection, Building codes, Beneficial use, Land tenure, Land use, Land classification, Zoning, State governments, Administrative agencies.  
**Identifiers:** \*National Flood Insurance Act of 1968, Flood Disaster Protection Act of 1973, Administrative regulations.

The purpose of Senate Bill 810 is to amend the Flood Disaster Protection Act of 1973 and the National Flood Insurance Act of 1968 to permit owners of properties located in nonparticipating communities to participate in the flood insurance program. Supporters of the bill maintained that individuals are unfairly penalized by their community's failure to enact flood plain zoning. Furthermore, they alleged that government agencies have identified some areas incorrectly as flood hazard areas, that many unincorporated communities have no authority to enact zoning, and that the present plan is difficult to administer. Opponents of the bill argued that the amendment is indefensible from a fiscal viewpoint and would frustrate the purpose of the act that the burden of flood relief should be on the flood prone property rather than all taxpayers, and that flood protection on an individual basis would be a hit or miss method which might increase the severity of flooding for neighboring land. The record contains 3 tables relating to state flood control and flood zoning

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acts. Also included are several substitute bills suggested by supporters. (Capehart-Florida)  
W76-07868

**CORPS OF ENGINEERS OVERSIGHT HEARINGS - 1975,**  
Hearings -- Sub Comm. on Water Resources -- Comm. on Public Works, U.S. Senate, May 9, 16, June 19, 20, and October 8, 1975, p. 1-1255.

Descriptors: \*Federal project policy, \*Decision making, \*Engineering structures, \*Navigable waters, \*Federal jurisdiction, Channels, Canal construction, Inland waterways, Environmental effects, Planning, Permits, Railroads, Cost sharing, Locks, Water policy, Federal government.  
Identifiers: \*Administrative regulations.

The Senate Subcommittee on Water Resources has conducted hearings as part of a continuing investigation into the civil works program of the Army Corps of Engineers. The subcommittee is directing its oversight activities toward an in-depth scrutiny of the navigation program as conducted by the Corps. Questions have been raised recently regarding many waterway policies, especially traditional Federal navigation cost-sharing mechanisms. Legislation has been introduced which would remove the navigation program from Corps jurisdiction and place it under the Department of Transportation. The policy for replacement of obsolete locks and dams, in effect since 1909, is being questioned, along with the environmental effects of navigation improvements and the expansion of Corps permit authorities over navigable waters. These hearings are meant to help define these problem areas and aid in devising solutions. Testimony is presented from representatives of states, the Corps of Engineers, port interests, waterway carriers, environmentalists, and railroads. Consideration is given to S. 838 which would grant the Corps authority to delegate its permit authority to states with a permit system that is duplicative of the Corps program. (Reinders-Florida)  
W76-07869

**UNITED STATES V. BEATTY, INC. (GOVERNMENT RIGHT TO RECOVER EXPENSES FOR CLEANING UP OIL SPILLS),**  
401 F. Supp. 1040-44 (WD Ky 1975). 5 p.

Descriptors: \*Oil spills, \*Oil pollution, \*Compensation, \*Kentucky, Ships, Judicial decisions, Legislation, Navigable waters, Water pollution sources, Pumping, Water pollution, Water policy, Coast Guard regulations, Legal aspects, Legal review, Damages, Penalties(Legal), Costs.  
Identifiers: \*Clean-up costs, Bilges.

This case arose when the captain of a ship went into town to purchase hardware equipment necessary to repair a broken fitting on the vessel's hull. In doing so, he left an inexperienced hand in charge of insuring that water from the bilge did not result in any discharge of oil. Unfortunately, between 5 and 10 gallons of oil were discharged into the river in the captain's absence. This discharge was discovered by the Coast Guard who contacted an oil company association to remove the oil from the water. The ship's captain returned after the clean-up operation had begun and protested that he had equipment to clean-up the spill at no cost to anyone. The Coast Guard ordered the association to continue the operation, however, since it was already on the scene. At a subsequent administrative hearing, the Coast Guard assessed the captain the clean-up costs paid by the plaintiff United States and also assessed a \$2,000 fine. Defendant captain then appealed, contending that the fine was excessive and that the clean-up costs were unreasonable and unnecessary. In affirming the Coast Guard's decision the District Court held that even though the fine and clean-up expenses were somewhat high they were nevertheless within the limits of the law. (Hoffman-Florida)

W76-07870

**UNITED STATES V. EUREKA PIPELINE CO. (PENALTY DETERMINATION UNDER FEDERAL WATER POLLUTION CONTROL ACT).**  
401 F. Supp. 934-43 (ND W. Va. 1975). 10 p.

Descriptors: \*Penalties(Legal), \*Federal Water Pollution Control Act, \*Constitutional law, \*Oil spills, Public rights, Oil pollution, Pipelines, Administrative agencies, Decision making, Legal aspects, Public rights, Water law, Legislation.  
Identifiers: Equal protection, Civil penalties, Criminal penalties.

Plaintiff United States was seeking civil penalties against defendant pipeline company for violations of the Federal Water Pollution Control Act (FWPCA) arising out of unauthorized oil discharges. The defendant contended that the FWPCA violated the Fifth Amendment since it allowed information gathered under its reporting requirements to be used in assessing civil penalties. The FWPCA was also alleged to violate the equal protection clause since it allowed the appropriate agency to consider the size and stability of the violating business in determining the size of the penalty. The district court rejected these contentions, however, finding the Act to be constitutional. Although acknowledging that the Act creates a unique situation whereby a person can become automatically liable for a civil penalty by following the only route available to avoid criminal prosecution, the court nevertheless found this to be the Congressional intent in enacting the Act. Thus, since no criminal action was involved, the Fifth Amendment was not violated. The equal protection claim was also rejected since the Fifth Amendment, unlike the Fourteenth, does not prohibit discriminatory action. Hence, no constitutional rights were infringed even if the Act did result in discrimination against established businesses. (Hoffman-Florida)  
W76-07871

**UNITED STATES V. GENERAL MOTORS CORP. (CRIMINAL AND CIVIL PENALTIES FOR OIL DISCHARGE INTO NAVIGABLE WATERS).**  
403 F. Supp. 1151-65 (D. Conn. 1975). 15 p.

Descriptors: \*Navigable waters, \*Oil spills, \*Federal Water Pollution Control Act, \*Third party effects, Judicial decisions, Legal aspects, Oil pollution, Water pollution sources, Penalties(Legal), Negligence, Oil, Industries, United States, Connecticut.  
Identifiers: Clean-up costs, Strict liability, Criminal penalties.

Defendant corporation had ceased operations of one of its plants and had drained oil storage tanks except for a reserve needed to protect machinery. Although the corporation continued to provide security for the plant, vandals managed to open valves on the tanks which resulted in an oil discharge into navigable waters. After the defendant refused to pay an oil-spill fine assessed against it, plaintiff United States brought this action to compel payment. The defendant contended that the Federal Water Pollution Control Act (FWPCA) does not authorize the imposition of a fine when the spill was the sole result of intentional misconduct by third parties. The defendant also contended that if the fine could be assessed, it should be a criminal penalty that could be enforced only in a criminal proceeding. The court rejected both contentions, however, holding that the FWPCA is based on a concept of strict liability which allows the imposition of a fine even in the absence of negligence. Because the defendant failed to introduce enough evidence to show that the fine constituted a criminal penalty the congressional intent to classify the fine as a civil penalty was held to be controlling. Despite the invalidity of

the defendant's contentions, the court reduced the fine to a \$1.00 nominal penalty. (Hoffman-Florida)  
W76-07872

**STATE V. CALLAWAY (FEDERAL WATER POLLUTION CONTROL ACT).**  
401 F. Supp. 524-31 (D. Minn. 1975). 8 p.

Descriptors: \*Degradation, \*Federal Water Pollution Control Act, \*Dredging, Federal jurisdiction, Regulation, Permits, Water quality control, Pollution abatement, State jurisdiction, Bodies of water, Water pollution control.  
Identifiers: Notice requirements.

Plaintiff State was seeking a declaratory judgement that the Corps of Engineers must comply with applicable state laws governing pollution abatement in its dredging operations in state waters. The plaintiff contended that failure to comply with these laws would result in a serious degradation in the quality of state waters. Defendant Corps of Engineers contended that the court had no jurisdiction to grant relief since the notice requirements of the Federal Water Pollution Control Act (FWPCA) had not been met. The court rejected this contention, however, holding that the FWPCA makes it clear that Congress intended to expand federal jurisdiction. Consequently, compliance with the notice requirements was not found to be a prerequisite to federal jurisdiction. The defendant also contended that plaintiff was not entitled to judgement since federal agencies need not obtain state discharge permits. Furthermore, even if permits must be obtained as a general rule, section 1344 of the FWPCA exempts dredging operations from state regulation. The court rejected these contentions, holding that state permit systems are to be the primary enforcement mechanism of the Act and must be followed. Because the plaintiff had an approved permit system, the court held Section 1344 to be inapplicable and granted the requested declaratory judgement. (Hoffman-Florida)  
W76-07873

**LESLIE SALT CO. V FROEHLKE (NAVIGABLE WATERS OF THE U. S. AS EXTENDING LANDWARD TO THE MEAN HIGH WATER LINE).**  
403 F. Supp. 1292-98 (ND Cal 1974). 7 p.

Descriptors: \*Federal jurisdiction, \*Water management(Applied), \*California, \*Federal Water Pollution Control Act, \*High water mark, Navigable waters, Construction, Permits, Jurisdiction, Legal aspects, Constitutional law, Legislation, Pacific coast region, Legal review, Administrative agencies, Federal government.  
Identifiers: Mean high water line, Mean higher high water line.

Plaintiff landowners were seeking a declaratory judgement that the defendant Corps of Engineers does not have jurisdiction under the Federal Water Pollution Control Act (FWPCA) over land situated above the mean high water line (MHW). The plaintiffs sought this relief after the Corps informed them that it was asserting jurisdiction over plaintiffs' coastal property, and would require permits for any work done bayward of the mean higher high water line (MHHW). The defendant noted that case law has limited the Corps jurisdictional authority under the Rivers and Harbors Act to land situated below the MHW line. The Corps contended, however, that its jurisdiction under the FWPCA is not so limited, and that its regulations defining navigable waters as extending landward to the MHHW line for Pacific Coast purposes was a reasonable interpretation of its jurisdictional authority under the FWPCA. The court agreed with the Corps' contention, finding that the legislative history of the FWPCA indicated that the Act should be given its broadest constitutional interpretation. Thus, the court found that the Corps jurisdiction under the FWPCA extended to all

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lands bayward of the MHHW line. (Hoffman-Florida)  
W76-07874

**DE GAYNER AND COMPANY V DEPARTMENT OF NATURAL RESOURCES (TEST FOR DETERMINING NAVIGABILITY OF A STREAM).**  
236 NW2d 217-24 (Wisc. 1975). 8 p.

Descriptors: \*Wisconsin, \*Diversion dams, \*Navigable waters, \*Beavers, Navigation, Permits, Administrative agencies, Decision making, Damsites, Streams, Construction, Area redevelopment, Administrative decisions, Judicial decisions. Identifiers: Water depth, Artificial conditions.

Defendant riparian owner had proposed the damming up of a local creek so as to create an artificial lake around which it was going to construct a residential development. In an effort to prevent this damming, a local citizens group sought a declaratory judgment from the Department of Natural Resources that the creek in question was a navigable stream; and therefore, a permit was required before any construction could begin. After the Department found the creek to be navigable, the defendant appealed. The major issue was whether the Department was correct in considering the fact that beaver dams on the creek raised the water depth to a sufficient degree to allow navigability. The defendant contended that beaver dams are an artificial condition that comes and goes and should not be considered in determining navigability. Since several witnesses had testified that the creek was not navigable under normal conditions because of unsuitable water depth, the defendant contended it was entitled to judgment. The Wisconsin Supreme Court affirmed the decision, however, noting that beavers have existed on the creek for the last forty years. Because of this duration, the beaver dams were a part of the normal conditions of the creek, and were proper factors to be considered by the department. (Hoffman-Florida)  
W76-07875

**BOTSCH V LEIGH LAND COMPANY (ODORS FROM FEEDLOT LAGOON AS NUISANCE).**  
236 NW2d 815-18 (Neb. 1975). 4 p.

Descriptors: \*Nebraska, \*Lagoons, \*Feed lots, \*Reasonable use, \*Cattle, Insects, Pollution abatement, Rural areas, Waste treatment, Waste water treatment, Judicial decisions, Legal aspects, Animal wastes(Wildlife), Nuisance algae. Identifiers: Nuisance.

Plaintiff farmer brought an action seeking to enjoin defendant corporate cattle farmer from continuing operation of its feedlot. The plaintiff contended that waste treatment lagoons situated on defendant's land created a nuisance due to offensive odors, dust, and insects originating from the lagoons. After the trial court dismissed the complaint, plaintiff appealed. Although conceding that a business enterprise is not a nuisance per se, the plaintiff contended that the severity of the conditions caused by defendant's lagoons was sufficient to make the feedlots operations a nuisance in fact. The defendant, however, argued that its feedlot located in a rural area containing several cattle-feeding operations, and thus could not be a nuisance. Although agreeing that enterprises have much more leeway in rural areas, the appellate court found that certain minimum levels must still be maintained. In this case, the court found that the odors and insects originating from the lagoons exceeded acceptable limits. Thus, the case was remanded for a determination of whether the lagoons could be operated in a manner that would sufficiently abate the problems caused. (Hoffman-Florida)  
W76-07876

**GETKA V LADER, JR. (REASONABLE USE RULE ELIMINATING COMMON ENEMY DOCTRINE).**  
238 NW2d 87-94 (Wisc. 1976). 8 p.

Descriptors: \*Adjacent land owners, \*Wisconsin, \*Surface drainage, \*Reasonable use, \*Culverts, Surface runoff, Surface waters, Standing waters, Judicial decisions, Reservoirs, Legal aspects, Common law, Drainage, Drainage area, Drainage patterns.

Identifiers: Common enemy doctrine, Injunctive relief.

Plaintiff landowners brought this action seeking to enjoin defendant adjacent landowners from continuing to drain water off their land into a culvert that brought water onto plaintiff's land. Plaintiffs contended that this excess drainage caused water to stand in depressions on their land, thus making it impossible to cross such areas with a tractor. After a judgment in favor of the plaintiffs, the defendants appealed. In addressing this case, the appellate court noted that Wisconsin had recently adopted a 'reasonable use' test to determine the rights of landowners to drain surface water from their land. Because that rule was made prospective only, however, the court found the common enemy doctrine to be the controlling test. Under that doctrine, landowners have the right to cause surface waters to drain off their land onto adjoining land if the water flows in a natural course of drainage. Although recognizing that the discharge of water from a reservoir was an exception to the doctrine, the court found that diverting water through a culvert did not come within this exception. Consequently, since the drainage water flowed in a natural course, the court reversed the trial court decision. (Hoffman-Florida)  
W76-07877

**OMERNICK V. DEPT. OF NAT RESOURCES (STATUTORY PRIOR RIGHT SUPERSEDED COMMON LAW DOCTRINE OF REASONABLE USE).**  
238 NW2d 114-16 (Wisc. 1975). 3 p.

Descriptors: \*Irrigation permits, \*Wisconsin, \*Diversion, \*Riparian rights, \*Constitutional law, Water rights, Judicial decisions, Administrative agencies, Decision making, Classification, Legislation, Legal aspects, Irrigation, Irrigation water, Streams, Trout, Permits. Identifiers: Surplus waters.

Plaintiff potato farmers proposed to divert water from a local stream to irrigate their land. After defendant Commission prevented such action until a permit was obtained, the plaintiffs brought suit, contending that the Commission had made the permit statute applicable by designating the stream as a trout stream without affording the plaintiffs an opportunity to be heard. The plaintiffs also alleged a denial of due process since the statute provided no means to determine the rights of riparian owners, yet granted such owners who were beneficially using the stream waters a veto power, without any showing of injury, over the granting of an irrigation permit. After the trial court sustained defendant's demurral, the plaintiffs appealed. The Wisconsin Supreme Court rejected the plaintiffs' claim that a hearing was required since the effect of a trout designation pertained only to surplus waters. In this case there was no allegation that the water to be diverted was surplus. The Court also found that the statute was unconstitutional because it granted certain riparian owners a veto power. The court noted that the statute indicated a legislative intent to abrogate the common law riparian right of irrigation by substituting a statutory permit procedure. Thus, the decision was affirmed. (Hoffman-Florida)  
W76-07878

**WILBER V. WHEELER (PRIOR VESTED RIGHTS NOT IMPAIRED BY SUBSEQUENT ISSUANCE OF WATER RIGHT CERTIFICATE).**  
543 P2d 1052-58 (Ore. 1975). 7 p.

Descriptors: \*Oregon, \*Irrigation, \*Irrigation permits, \*Water distribution(Applied), Irrigation practices, Irrigation water, Water law, Legal aspects, Permits, Irrigated land, Water rights, Judicial decisions, Legal review, Distribution systems, Irrigation systems, Regulation.

Plaintiff landowner brought a mandamus proceeding against defendant state engineer to require the defendant to issue a corrected certificate of water rights on certain lands owned by the plaintiff. In 1941, the plaintiff's predecessor in interest had received a permit to irrigate 167.1 acres of land, although the final proof survey in 1954 showed that 219.6 acres were being irrigated, some of which did not belong to the plaintiff's predecessor. A 1956 certificate of water right for 167.1 acres included only the uppermost 167.1 acres of the 219.6 shown, 17 of which were owned by a third party. The plaintiff contended this was a clerical error and sought correction. The Supreme Court of Oregon disagreed, holding that Oregon statutory law made certificates of water right issued by a state engineer conclusive evidence of title to water rights unless a contest was brought within three months of issuance. The Court went on to note, however, that persons could apply for water rights to lands which they do not own but which they intend to irrigate. (Welch-Florida)  
W76-07879

**BUDD V. BISHOP (LIMITATION TO BENEFICIAL USE OF WATER RIGHTS OF ANY APPROPRIATOR).**  
543 P2d 368-73 (Wyo. 1975). 6 p.

Descriptors: \*Wyoming, \*Prior appropriation, \*Competing uses, \*Irrigated land, \*Irrigation, Regulated flow, Regulation, Water allocation(Policy), Water utilization, Water law, Legal aspects, Adjudication procedure, Preferences(Water rights), Diversion, Priorities, Proration, Appropriation, Water rights. Identifiers: Standing(Legal).

Plaintiff water rights owner brought this action to challenge the interpretation given to the state surplus plus water law by defendant state officers. The plaintiff further challenged the constitutionality of the statute. The surplus water statute was enacted to provide for the vesting of the right to use excess stream water among several appropriators. The statute limited the amount and uses of water to be appropriated and vested surplus water use priority to those rights acquired before March 1, 1945. The Supreme Court of Wyoming remanded the case, ordering the deletion of the lower court's conclusion of law that the statute was constitutionally valid. Furthermore, it held that the plaintiff had no standing to challenge the constitutionality of the surplus water law where his rights were obtained in accordance with such law. The plaintiff could not challenge surplus water law by contending there were state constitutional violations relating to water rights for storage of water when the plaintiff himself did not hold such rights. (Welch-Florida)  
W76-07880

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V METZGER (MAXIMUM LEVEL OF GROUND WATER AT LEAST FOUR FEET BENEATH EXCAVATION FOR SEWER).**  
347 A2d 743-46 (Pa. Com. Ct. 1975). 4 p.

Descriptors: \*Pennsylvania, \*Pollution abatement, \*Water pollution control, \*Sewage disposal, Waste disposal, Sewage, Sewerage, Waste water, Sanitary engineering, Legal aspects, Judicial review, Administrative agencies, Administrative

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decisions, Building codes, Control, Governments, Standards, Water quality standards, Design standards.

Identifiers: Administrative regulations.

Plaintiff appellant builder brought this action against defendant to overturn a permit disapproval concerning installation of a sewage disposal system. Local authorities had disapproved plaintiff's permit for failure to comply with state environmental quality standards. Plaintiff contended that evidence of standards met in nearby excavations showed that quality standards in the area were met and alternatively that such standards, when not reasonably related to pollution control, were an unlawful exercise of police power. The Commonwealth Court of Pennsylvania found that the administrative regulations were subject to the same heavy burden of proof required to invalidate legislation and that this burden was not met. The plaintiff had the burden to show compliance with state regulations beneath the proposed excavation, and his testimony concerning nearby excavations was insufficient to do so in the absence of additional evidence establishing the existing soil condition beneath the proposed site. (Welch-Florida) W76-07881

**BILMONT V. UMPQUA SAND AND GRAVEL, INC. (DETERMINATION OF BOUNDARY LINE LOCATED IN RIVER BED TO FIND HOW MUCH GRAVEL HAD BEEN TAKEN).**

542 P2d 884-92 (Ore. 1975). 9p, 1 map.

Descriptors: \*Oregon, \*Boundaries(Property), \*Gravels, \*Boundary disputes, \*River beds, Adjacent land owners, High water mark, Ownership of beds, Legal aspects, Water law, Water rights, Banks, Rivers, Streambeds, Streams, Judicial decisions, Legal review, Dredging.

Plaintiff land owner brought this action to recover the value of river gravel alleged to have been removed from his property by defendant adjacent land owner. The plaintiff and the defendant each owned adjoining parcels of land along a non-navigable stream. The defendant alleged that gravel was taken from his portion of the river bed and that any gravel taken from the plaintiff's portion was in exchange for topsoil delivered to the plaintiff. The major issue at trial involved the interpretation of the phrase 'bank of the river' which was used in the plaintiff's deed. The Supreme Court of Oregon disagreed with the trial court, and held that since this was a non-navigable stream, 'bank' did not refer to the high water mark but to the middle or thread of the stream. The Court went on to hold that the disputed boundary line in the river bed would be established by extending a perpendicular line from the thread of the terminus of the plaintiff's upland line at the high water mark. The case was remanded, however, to determine if there had been any willful confusion of the gravel rights by the defendant. (Welch-Florida) W76-07882

**CORONWALTH DEPT OF ENVIRONMENTAL RESOURCES V CITY OF LEBANON (IF FLUORIDATION NOT A PREREQUISITE FOR ISSUANCE OF WATER SUPPLY PERMIT, THEN CANNOT BE FOR MODIFICATION THEREOF).**

348 A2d 166-69 (Pa Com Ct 1975). 4 p.

Descriptors: \*Pennsylvania, \*Fluoridation, \*Water supply, \*Public health, \*Water permits, Water treatment, Fluorides, Fluorine, Treatment, Public health, Supply, Water yield, Legal aspects, Permits, Water law, Administration, Regulation, Water allocation(Policy), Water resources development, Judicial decisions.

Identifiers: Administrative regulations.

Appellant city appealed an Environmental Hearing Board order which had upheld appellee Department of Environmental Resources' refusal of ap-

pellant's request for a modification of the city's water supply permit to discontinue fluoridation. Appellant had been issued a water supply permit in 1970 which had recited the city's intent to fluoridate the water supply. In 1973 the city had requested the modification which was refused. Appellee contends that statutory authority vests the appellee with discretionary powers to determine issuance and modification of water permits according to its own determination of conditions which are not 'prejudicial to the public health'. The Commonwealth Court held that appellee could not refuse the permit modification on the grounds of public health in view of the fact that fluoridation was not a precondition for the initial issuance of a water permit and thus its absence in a water supply could not be deemed prejudicial to public health. (Welch-Florida) W76-07883

**LOVELADIES PROPERTY OWNERS ASS'N V. RAAB (FILING OF WETLANDS MAP PRE-REQUISITE TO REGULATION OF LANDS UNDER WETLANDS ACT OF 1970).**

348 A2d 540-43 (NJ Superior Ct 1975). 4 p.

Descriptors: \*New Jersey, \*Permits, \*Wetlands, \*Land reclamation, \*Land management, Marshes, Conservation, Reclamation, Coastal marshes, Coastal engineering, Regulation, Administrative agencies, Administrative decisions, Maps, Mapping, Legal aspects, Control, Legislation, Preservation.

Identifiers: Administrative regulations, Fill permits, Injunctive relief.

Plaintiff property owners' association brought this action seeking a declaration that defendant property owners' lands were wetlands within the meaning of the New Jersey Wetlands Act of 1970. The plaintiffs also sought an injunction to restrain the defendant from depositing fill on the lands and to compel him to restore the lands to their previous condition. The defendant had filled part of his lands, which had been designated as wetlands on the Act's required map, subsequent to the proper filing of the map but prior to the Department of Environmental Protection's order which provides for permits for regulated activities upon such wetlands. The Superior Court held that coastal wetlands were not exempt from the Act's requirements. The court held, however, that coastal wetlands were not exempt from the Act's requirements. The court also held, however, that the activities subject to regulation are not prohibited until a wetlands map has been filed and an order promulgated. Thus the plaintiff's action was dismissed. (Welch-Florida) W76-07884

**SANDS POINT HARBOR, INC. V. SULLIVAN (REGULATION OF USE OF MARSHES AND WETLANDS: VALID EXERCISE OF GOVERNMENT POWER).**

346 A2d 612-14 (NJ 1975). 3 p.

Descriptors: \*New Jersey, \*Wetlands, \*Marshes, \*Regulation, \*Constitutional law, Conservation, Legislation, Legal aspects, Coastal marshes, Land reclamation, Governments, State governments, Land, Administrative decisions, Land management, Water law, Preservation.

Identifiers: Administrative regulations.

Plaintiff property owner brought this action to challenge orders adopted by defendant Department of Environmental Protection pursuant to the New Jersey Wetlands Act. The plaintiff contended that the orders promulgated so regulated the use of wetlands and marshes as to deprive him of constitutionally guaranteed equal protection and that such regulations were an unconstitutional taking of property without just compensation. The New Jersey Superior Court held that the regulations concerned environmentally important lands and were a valid exercise of governmental power. The

court further held that the geographic scope of coastal wetlands did not isolate equal protection because there were reasonable grounds for the different treatment of lands in different areas of the state. Since the plaintiff had demonstrated no practical use of his lands according to statutory procedures, he failed to show that any taking had occurred. (Welch-Florida) W76-07885

**IN RE WILDLIFE WONDERLAND, INC. (VERMONT ENVIRONMENTAL BOARD FINDINGS OF POSSIBLE GAME FARM WATER POLLUTION ENOUGH TO DENY PERMIT).**

346 A2d 645-54 (Vt. 1975). 10 p.

Descriptors: \*Vermont, \*Land use, \*Permits, \*Land development, \*Legal review, \*Water pollution, Soil erosion, Water law, Conservation, Legislation, Legal aspects, Erosion, Erosion control, Land, Soil management, Water management(Applied), Administrative agencies, State governments, Land management.

Identifiers: Administrative regulations, Standing(Legal).

Wildlife Wonderland, Inc. filed an application for a land use permit authorizing the construction and operation of a commercial game farm. After the District Environmental Commission granted the permit, environmental opponents appealed to the Vermont Environmental Board which disapproved the permit. Wildlife contended that the alleged pollution which would result from such construction and operation was not supported by substantial evidence and that the board was considering matters beyond its powers. The Supreme Court of Vermont held that while particular comments in the findings indicated the Board had overstepped its jurisdiction, no reversible errors had been committed. The court further held that substantial evidence of potential pollution had been submitted to the Board which supported its conclusions and denial of a land use permit. (Welch-Florida) W76-07886

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V. FLEETWOOD BOROUGH AUTHORITY (CRIMINAL ASSESSMENT AGAINST BOROUGH FOR VIOLATION OF CLEAN STREAMS LAW).**

346 A2d 867-69 (Pa. Com. Ct. 1975). 3 p.

Descriptors: \*Pennsylvania, \*Pollution abatement, \*Streams, \*Penalties(Legal), \*Water pollution control, Control, Regulation, Legal aspects, Judicial decisions, Law enforcement, Water law, Legislation, Water quality, Water quality standards, Waste water disposal, Waste water(Pollution), Water pollution, Water quality control, Abatement, Organic wastes, Fishkill, Sewage effluents.

Identifiers: Nuisance(Legal aspects), Pennsylvania Clean Streams Law.

Plaintiff Commonwealth Department of Environmental Resources brought action against defendant borough authority for violation of the state Clean Streams Law. The defendant admitted that a fish kill occurred as a result of a violation of the terms of its sewer permit which required the removal of 85% of the organic pollution load from final effluents discharged into a certain stream. Despite this admission, defendant contended that its activities were only a nuisance under the Clean Streams Law, and thus were not punishable under the criminal abatement remedies of the Law. The Commonwealth Court of Pennsylvania found that defendant had violated its permit and discharged substances for which it had no permit, both of which constituted a violation of the Clean Streams Law. In addition, the defendant was found liable under both the criminal and abatement remedies sections since the stated purpose of the Law was to provide additional remedies to abate the pollution of state waters.

## WATER RESOURCES PLANNING—Field 6

### Water Law and Institutions—Group 6E

W76-07887

**COMMONWEALTH DEPARTMENT OF ENVIRONMENTAL RESOURCES V MONONGAHELA AND OHIO DREDGING COMPANY (INSURANCE OF CEASE AND DESIST ORDER TO DREDGING COMPANY WITHOUT A HEARING NOT A DENIAL OF DUE PROCESS).**  
347 A2d 879-84 (Pa. Com. Ct. 1975). 6 p.

Descriptors: \*Water pollution abatement, \*Pennsylvania, \*Navigable rivers, \*River regulation, \*Dredging, River flow, Regulation, Legal aspects, Administrative agencies, Running waters, Surface waters, Administration, State governments, Water rights, Administrative Decisions, Water law, Constitutional law, Navigable waters, Judicial decisions.

Identifiers: Administrative regulations, Navigation obstructions.

Plaintiff Department of Environmental Resources brought this action to enforce a cease and desist order restraining defendant dredging company from acts which would violate the Water Obstructions Act by changing a cross section of the Allegheny River. The defendant contended that the plaintiff did not have authority to issue orders against dredging companies performing maintenance dredging, and that the facts did not justify the issuance of the order. The Commonwealth Court of Pennsylvania held that the state legislature can determine what can be done with the soil at the bottom of navigable streams. Furthermore, this power, as reflected in the Water Obstructions Act, gave authority to the plaintiff to issue a cease and desist order if such order was supported by facts sufficient to show a violation of the Act. The expert testimony offered in this case was found to be sufficient to support findings of fact that activities of the defendant would change a cross section of the river in violation of the Act. The Court also found that the defendant was not denied a due process hearing in that the hearing was convened before the board and the defendant could have challenged the order at that time. (Welch-Florida) W76-07888

**CITY OF CONCORD V WATER SUPPLY AND POLLUTION CONTROL COMMISSION (ORDER TO COVER OPEN HIGH SERVICE DISTRIBUTION RESERVOIR NOT UNREASONABLE).**  
347 A2d 173-74 (NH 1975). 2 p.

Descriptors: \*New Hampshire, \*Water supply, \*Water pollution, \*Bacteria, \*Reservoirs, Reservoir storage, Reservoir operation, Reservoir construction, Water sources, Water tanks, Water resources, Water quality, Water quality standards, Water pollution control, Water pollution sources, Legal aspects.

Plaintiff city appealed an order from the defendant Water Supply and Pollution Control Commission which had required the plaintiff to cover its high service distribution reservoir. The Commission had found that the plaintiff's reservoir was a source of bacterial and viral contamination of the city's water distribution system. Expert testimony showed that the reservoir was open to pollution from sea gulls, water fowl and humans. The defendant contended that records of actual bacteriological counts taken from the reservoir for the years at issue were not introduced. The Supreme Court of New Hampshire held that the order was not unreasonable in view of the evidence and that the Commission properly relied upon testimony of its staff experts in determining the necessity of such an order. (Welch-Florida) W76-07889

**COMMONWEALTH DEPT. OF ENVIRONMENTAL RESOURCES V MILLS SERVICE, INC. (ABUSE OF DISCRETION BY ENVIRONMEN-**

**TAL HEARING BD IN DETERMINATION OF POLLUTING PENALTY).**  
347 A2d 503-07 (Pa Com Ct 1975). 5 p.

Descriptors: \*Permits, \*Waste treatment, \*Waste disposal, \*Pennsylvania, \*Penalties(Legal), Facilities, Streams, Administrative agencies, Discharge(Water), Industrial wastes, Legal aspects, Pollution abatement.

After the operator of an industrial waste treatment facility was found to have allowed an unauthorized discharge of waste into a creek in violation of the Clear Streams Act, the Environmental Hearing Board revoked the facility's waste permit. The facility appealed this decision, contending that the revocation was an excessive penalty. The facility noted that only one isolated discharge was involved in the violation, and that the operator had taken immediate action after the discharge to prevent further discharges. While acknowledging that the discharge violated the Act, the facility stressed that the violation was the unintentional result of a negligent omission from its permit application. The Environmental Board, however, contended that an intentional violation is not a prerequisite for the exercise of its revocation power. The court rejected this contention, finding that the intent of the violator is a relevant issue. In this case, the court found that there was not sufficient evidence showing intentional misconduct to justify the imposition of such a harsh penalty. Consequently, the facility's permit was reinstated. (Hoffman-Florida) W76-07890

**LEAHAN V. COMMONWEALTH DEPT. OF TRANSPORTATION, (DISCHARGE OF WASTE MATERIALS ONTO LAND OWNER'S PROPERTY NOT A DEFACTO TAKING BY STATE).**  
349 A2d 492-93 (Pa. Com. Ct. 1975). 2 p.

Descriptors: \*Pennsylvania, \*Adjacent land owners, \*Ditches, \*Sewerage, \*Eminent domain, Drainage, Trespass, Negligence, Third party effects, Waste disposal, Judicial decisions, Wells, Water pollution, Highways, State governments.

Defendant state maintained a ditch that ran along a state highway. For a number of years, plaintiff landowners' neighbors discharged sewage materials into the highway ditch which ran across the plaintiffs' land. This sewage discharge caused the pollution of plaintiffs' well and other distasteful conditions. After the state refused to prohibit the neighbors' discharges the plaintiffs brought suit for the value of their land, contending that the pollution from the ditch constituted a de facto taking. After the lower court found the plaintiffs' allegations to constitute a cause of action, the state appealed, contending that any redress should be in a trespass action rather than an eminent domain proceeding because the property damage involved was the result of the negligent conduct of third parties. The court found the state's contention to be well supported by recent state case law and thus dismissed the plaintiffs' petition. (Hoffman-Florida) W76-07891

**REDEVELOPMENT AUTHORITY V. SPENCER (TAKING OF PROPERTY IN FLOOD PREVENTION PROGRAM).**  
350 A2d 442-45 (Pa Com Ct 1976). 4 p.

Descriptors: \*Constitutional law, \*Flood protection, \*Condemnation, \*Pennsylvania, \*Damages, Flood control, Legal aspects, Judicial decisions, Eminent domain, Public rights, Water law, Adjacent landowners, Compensation, Constitutional law, Real property.

Identifiers: Equal protection.

In order to implement a flood prevention project, a redevelopment authority was exercising its power of eminent domain over a large land area. Defen-

dant landowners, who operated a junkyard on their premises, raised several objections to the taking of their land including that the taking was for a private rather than public purpose and thus should be prohibited. After a decision in favor of the state, the landowners appealed. In addition to the private purpose defense, the landowners contended that the damages allowed under the condemnation statute violated their equal protection rights. The appellate court rejected these contentions, however, finding the landowners first contention to be without merit since no evidence had been introduced to show that governmental authorities had implemented the flood project in an arbitrary, capricious or illegal manner. As to the question of damages, the court found that the statute awarding landowners the pre-condemnation value of their land did not violate their equal protection rights. The fact that some landowners may receive some additional compensation did not impair the defendant's constitutional right to just compensation. (Hoffman-Florida)  
W76-07892

**STATE V LANG (TIDAL WETLANDS ACT INAPPLICABLE TO PROPERTY WHERE TIDE MUST BE ARTIFICIALLY INDUCED INTO DITCHES).**  
376 NYS2d 941-45 (Sup Ct 1975). 5 p.

Descriptors: \*New York, \*Wetlands, \*Landfills, \*Dredging, \*Tidal marshes, Industrial plants, Coastal marshes, Environmental effects, Judicial decisions, Legal aspects, Terrestrial habitat, Aquatic habitat, Industrial plants, Coasts, Real property.

Defendant landowner was charged with altering tidal wetlands on his property in violation of the Tidal Wetlands Act. Plaintiff state subsequently instituted this action to enjoin the defendant from any further filling or dredging activities. The defendant contended that any wetlands on his property were artificially created by industrial activities on adjoining lands; consequently, since the land did not contain natural wetlands, the Act was inapplicable. The defendant stressed that his land consisted of only a one-acre tract in the middle of a large tract of industrially developed lands. In dismissing the state's action, the court noted that the purpose of the Act is to prohibit wetland activities that would have an adverse effect on the marine terrestrial environment. Since this objective would not be advanced by enjoining future actions by the defendants, the plaintiff's complaint was found to be without merit. (Hoffman-Florida) W76-07893

**GRINNELL V KOWARC (CONSTRUCTION OF LAKESIDE DOCK DEPENDENT UPON PROPERTY OWNERSHIP).**  
376 NYS2d 759-60 (Sup Ct 1975). 2 p.

Descriptors: \*Encroachment, \*Construction, \*New York, \*Docks, \*Land tenure, Permits, Judicial decisions, Real property, Legal aspects.

Both parties to this action had licenses allegedly giving them the authority to construct lakeside docks at the same location. When both parties attempted to construct docks, one of the licensees brought an action to remove encroachment by the other licensee. After judgement was granted to the plaintiff, the defendant appealed. The appellate court reversed and remanded, finding that the rights of the parties could not be resolved until the ownership of the land could be determined. Until such ownership is determined, both parties would be viewed as squatters since there was no evidence that the licensor had the authority to grant a license. (Hoffman-Florida)  
W76-07894

**TORTOLANO V. DIFILIPPO (LANDOWNER'S ALTERATION OF LAND GRADE CAUSING**

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#### DAMAGE TO ADJOINING LAND IMPOSING AFFIRMATIVE DUTY TO CHANGE AGAIN.

349 A2d 48-53 (RI 1975). 6 p, 1 append.

Descriptors: \*Adjacent land owners, \*Landfills, \*Retaining walls, \*Excess water, Flow, Land tenure, Damages, Reasonable use, Judicial decisions, Drainage water, Runoff, Graded, Gradients(Streams), \*Rhode Island, Drainage effects, Drainage patterns(Geologic).

Identifiers: Common enemy doctrine.

Plaintiff landowner brought suit to enjoin a neighboring landowner to construct a retaining wall to prevent debris-carrying water from flowing across defendant's property onto plaintiff's land. This debris was allegedly the result of a filling operation that raised the level of defendant's land 12 to 14 feet above the natural grade resulting in a large increase in the flow of water across his land. After a judgement in favor of the plaintiff, the defendant appealed, contending that the 'common enemy' doctrine permitted his allegedly reasonable use of his property. The Rhode Island Supreme Court rejected this contention, however, finding that the plaintiff's claim was based on damages caused by the deposit of debris and silt on his property. The common enemy doctrine was thus inapplicable. The court then went on to discuss the measure of damages. (Hoffman-Florida) W76-07895

#### PEOPLE V. AMERADA HESS CORP. (RIPARIAN RIGHT TO BUILD WALL TO PREVENT EROSION OF BOUNDARY).

375 NY 52d 1001-05 (Crim. Ct. N. Y. City 1975). 5 p.

Descriptors: \*New York, \*Landfills, \*Concretes, \*Navigable waters, \*Boundary disputes, State jurisdiction, Streams, Boundaries(Property), High water mark, Water pollution control, Riparian rights, Legal aspects, Water law, Navigation, Real property, Siltation.

Plaintiff State brought this action against defendant corporation for the allegedly unauthorized filling of waterfront property in violation of statutory provisions. The defendant was charged with dumping broken concrete into the water and along the bank of a navigable creek in order to extend its property line. Defendant contended that its actions did not constitute a filling operation since the concrete was placed on the bank above the high water mark to prevent pollution by material silting and was not designed and did not result in extending the boundary line. Before discussing the facts of the case, the court noted that the State has the authority to regulate navigable waters and to prevent actions that will impair navigability. The statutory provision involved in this case was promulgated pursuant to that authority. The provision, however, was not meant to prevent a riparian owner from improving and protecting his property so long as any improvement did not interfere with navigability. Consequently, since no evidence was introduced showing that navigability was impaired, the action was dismissed. (Hoffman-Florida). W76-07896

#### TRUSTEES OF THE FREEHOLDERS AND COMMONALITY V HEILNER (PUBLIC EASEMENT IN SURFACE OF NAVIGABLE BAY).

375 NYS2d 761-76 (Sup. Ct. 1975). 16 p.

Descriptors: \*New York, \*Landfills, \*Boundaries(Property), \*Easements, \*Coasts, \*Public access, Contract, Right-of-way, Accretion, Environmental effects, High water mark, Avulsion, Access routes, Navigable waters, Erosion, Boundary disputes, Public rights, Public lands.

Identifiers: Coastal property.

Defendant builder had entered into a contract to purchase coastal property on which he planned to construct a motel. Because of environmental concerns, plaintiff town sought to enjoin the defendant from filling in the land below the high-water mark. The town also sought a declaratory judgment describing the boundary lines of town lands abutting the shoreline of the land in question and declaring the existence of a public easement across such lands. After a complete analysis of applicable general principles, the court determined that the bay waters in question were navigable. Consequently, the defendant had title to the farthest seaward boundaries of the deed except as to land lost by erosion or gained by accretion. The defendant was also held to have the rights to fill in land lost by avulsion if original boundary lines could be determined, such fill-in right not to apply to land lost by erosion. As to the easement contention, the court held that the public has an easement over all land seaward of the high water mark. In this case, however, the public was deemed not to have an easement granting access to such land across the defendant's property. Thus, the plaintiff's complaint was dismissed in its entirety. (Hoffman-Florida). W76-07897

#### WEISZMANN V. DIST. ENGINEER, U. S. ARMY CORPS OF ENGINEERS (JURISDICTION OF CORPS OF ENGINEERS OVER LANDLOCKED CANAL IN RESIDENTIAL SUBDIVISION).

526 F2d 1302-06 (5th Cir 1976). 5 p.

Descriptors: \*Florida, \*Federal jurisdiction, \*Navigable waters, \*High water mark, \*Canals, Sedimentation, Navigation, Area redevelopment, Legislation, Legal aspects, Land tenure, Bodies of water, Rivers and Harbors Act, Permits, Legal review.

Identifiers: Commercial Navigation.

Plaintiff developer brought an action seeking to enjoin the Corps of Engineers from exercising jurisdiction over two canals dug by the developer in connection with a residential subdivision. After an unfavorable judgment, the plaintiff appealed, contending that the canals were situated on private land above the mean high tide level and were thus outside of the jurisdiction of the Corps under the Rivers and Harbors Act. The plaintiff also contended that jurisdiction was lacking since the canals were not navigable waters by reason of their limited non-commercial use, and that even if they were navigable waters, they had no effect on the course or condition of any other navigable waters. The Fifth Circuit Court rejected plaintiff's first contention, finding that the MHTL jurisdictional limitation was merely an internal Corps policy, and was not contained in the Act. The court found, however, that the Corps had jurisdiction over only one canal, because the other canal did not connect to any body of water and was thus outside the scope of the Act. The court went on to find that the jurisdictionally covered canal did have an effect on a navigable body of water in that it caused sediment to enter a pre-existing canal. Finally the court held that the canal need not actually carry commerce to meet the test of navigability. Thus, the decision was affirmed in part and reversed in part. (Hoffman-Florida). W76-07898

#### UNITED STATES V. SEXTON COVE ESTATES, INC. (DREDGING SHOREWARD OF THE MEAN HIGH TIDE LINE: PROHIBITIONS OF THE RIVERS AND HARBORS ACT).

526 F2d 1293-1301 (5th Cir. 1976). 9 p.

Descriptors: \*Florida, \*Rivers and Harbors Act, \*Canals, \*Federal jurisdiction, \*Navigable waters, Constitutional law, High water mark, Legislation, Area redevelopment, Construction, Penalties(Legal), Legal review, Administrative agencies, Federal government.

Identifiers: Restoration, Personal liability.

Plaintiff United States brought this action seeking to require defendant corporate residential developer to restore ten canals, all of which were allegedly altered in violation of the Rivers and Harbors Act, to their original condition. After a judgement in favor of the plaintiff, the defendants appealed. The defendant set forth the following defenses: the Corps of Engineers had no jurisdiction since the canals were above the mean high tide line (MHTL); there was no violation of the Act; there was no statutory basis for holding the president personally liable for the restoration; and the restoration relief granted was inappropriate. The Fifth Circuit court found that MHTL jurisdictional limitation was not contained in the Act, but was an internal Corps policy. Thus, the Corps could exercise jurisdiction. The court also found, however, that the construction of five of the canals did not affect any navigable waters and thus did not violate the Act. Furthermore, the Act did not authorize the imposition of personal liability on a corporate official. Because of the uncertainty involved in awarding relief in environmental cases, the case was remanded for a hearing on whether the order of restoration was an appropriate and equitable form of relief. (Hoffman-Florida) W76-07899

#### JOSEPH G. MORETTI, INC. V. HOFFMAN (AFTER-THE-FACT DREDGE AND FILL PERMITS).

526 F2d 1311-14 (5th Cir 1976). 4 p.

Descriptors: \*Florida, \*Dredging, \*Permits, \*Administrative agencies, \*Federal jurisdiction, Decision making, Legal aspects, Administrative decisions, Legal review, Judicial decisions, Adoption of practices, Landfills, Federal government.

Identifiers: \*Dredge permits, \*Procedural requirements(Legal), Delegation, Discretionary authority.

Plaintiff residential developer was seeking to obtain an after-the-fact dredge and fill permit from the Corps of Engineers. After the Corps' denial of permit was upheld by the trial court, the plaintiff appealed, contending that they had refused to consider evidence favorable to the plaintiff and that the decision was not supported by substantial evidence. In addition, the plaintiff contended that the Secretary of the Army acted in error when he refused to review the recommendation to deny the permit. The court rejected the above contentions, however, and affirmed the decision. The court held that the Secretary of the Army has the statutory authority to delegate his discretionary authority to the Chief of the Corps of Engineers and therefore was not required to review the decision of the Corps. The court also found that the Corps was justified in excluding certain of plaintiff's documents from its records since those documents were of dubious relevancy. Finally, the court held that the administrative record contained sufficient evidence to justify the Corps' denial of the permit. (Hoffman-Florida) W76-07900

#### UNITED STATES V. JOSEPH G. MORETTI, INC. (JURISDICTION OF THE CORPS OF ENGINEERS OVER CANALS CONSTRUCTED ABOVE MEAN HIGH TIDE LINE).

526 F2d 1306-1311 (5th Cir 1976). 6 p.

Descriptors: \*Rivers and Harbors Act, \*Florida, \*High water mark, \*Penalties(Legal), \*Dredging, Permits, Administrative agencies, Administrative decisions, Constitutional law, Legislation, Judicial decisions, Legal review, Federal jurisdiction.

Identifiers: Restoration, After-the-fact permits.

Plaintiff United States sought to enjoin defendant developer from conducting dredge and fill work in Florida Bay. After the trial court granted the injunction, the defendants appealed, contending that it had not violated provisions of the Rivers and

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Harbors Act, and that even if violations were found to exist, the trial court had no authority to order the restoration of the land fill area. Although the Fifth Circuit rejected these contentions, it found that the defendant had not been given its statutory right to pursue an after-the-fact permit. Subsequently, when the Corps of Engineers denied the after-the-fact permit, the defendant appealed to the trial court which affirmed. This time, however, the trial court revised its order so that the defendant was required to restore land both bayward and landward of the mean high tide land (MHTL). The defendant once again appealed, contending that the restoration order pertaining to areas above the MHTL were invalid since the Corps did not have jurisdiction over such areas under the Rivers and Harbors Act. The court rejected this argument, finding that the MHTL jurisdictional limitation was merely an internal Corps policy and was not mandated by the Act. Thus, the Corps had jurisdiction. The case was again remanded, however, for an evidentiary hearing on the manner of restoration to be carried out. (Hoffman-Florida)  
W76-07901

#### SARASOTA COUNTY V. GEN DEV CORP (ENVIRONMENTAL LAND AND WATER MANAGEMENT ACT OF 1972 NOT EFFECTING COUNTY AUTHORITY TO CHALLENGE CITY ZONING).

325 So2d 45-7 (2d DCA Fla 1976). 3 p.

Descriptors: \*Land development, \*Administrative agencies, \*Zoning, \*Local governments, Land management, Land use, Water policy, Water law, Administration, Jurisdiction, Legal review, Land tenure, Judicial decisions, Legislation, Legal aspects, Real property.

Plaintiff county brought an action seeking to have a city's approval of a land development project overturned. The county contended that improper procedures had been followed by the city in approving the development and that the corporation in charge of the development had recorded plats of the subdivision without the required approval of the County Commissioners. In addition, the county was seeking a declaratory judgment that it had the right to appeal the city's order to the Florida Land and Water Adjudicatory Commission. After the trial court dismissed the action, the plaintiff appealed. The District Court remanded the case, finding that the county was entitled to a determination pertaining to its right to exercise control over subdivisions by way of certain recording statutes. The court agreed, however, that the city has zoning jurisdiction over the land in question and thus the county had no standing to attack any improper procedures pertaining to the approval of the development. Finally, the court held that the county did not have the right to appeal to the Adjudicatory Commission. The court noted that recent judicial interpretations had strictly construed the statute pertaining to regional development. Thus, since the county was not specifically given the statutory authority to seek review of any development order, it had none. (Hoffman-Florida)  
W76-07902

#### VINCENT V MEAUX (CHANGING THE SHAFT OF A WELL BECAUSE WATER TABLE LOWER NOT CONSTITUTING A NEW WELL BUT PRESERVATION OF SERVITUDE).

325 So2d 346-49 (La. Ct. App. 1975). 4 p.

Descriptors: \*Louisiana, \*Water rights, \*Wells, \*Prescriptive rights, \*Water table, Steel pipes, Well casings, Groundwater, Water law, Legal aspects, Contracts, Compensation, Water utilization, Land tenure, Judicial decisions, Water demand, Water level fluctuations.  
Identifiers: Servitudes.

A 1941 partition agreement provided that one tract would be divided into three lots, with each lot hav-

ing a water right in a well located on the No. 3 lot. Plaintiff lot owner who was seeking a declaration of his rights under the agreement, was attempting to prevent the defendant, a predecessor-in-interest to one of the original lot owners, from withdrawing water from the well. Evidence introduced at trial showed that the well had dried up in 1951, and that the defendant's predecessor was forced to lower the well and to recast it with steel. After this date, the plaintiff had paid a fee for use of water from the well. The defendant contended that the servitude was extinguished when the well was deepened; furthermore even if the servitude was not then extinguished, it was later extinguished by prescriptive rights since the plaintiff's payment for the water was not a use of the servitude. The court rejected these contentions, however, finding that the lowering and recasting of the well did not constitute the digging of a new well and thus did not extinguish the servitude. The court also found that the prescriptive period had not run since the well had been used by the plaintiff at least once every 10 years. The fact that the plaintiff paid for that use was irrelevant to the question of whether the prescriptive period had run. (Hoffman-Florida)  
W76-07903

#### MORGAN V. CULPEPPER (FLOODING OF LOW LYING AREA CAUSING ENCLOSURE OF PROPERTY TO EXTENT REQUIRED TO IMPOSE SERVITUDE).

324 So 2d 598-606 (La. Ct App 1975). 9 p.

Descriptors: \*Louisiana, \*Flooding, \*Land tenure, \*Access routes, \*Roads, Transportation, Compensation, Leases, Flood frequency, Overflow, Runoff, Right-of-way.

Identifiers: Landlocked property, Servitude.

Because his land had no access to a public road, plaintiff landowner brought an action seeking to obtain a servitude of passage across land owned by defendant adjacent landowners and leased by other defendants. After the trial court dismissed the action, the plaintiff appealed contending that the plaintiff had access to a public road by any one of several roads and thus was not entitled to relief. The Louisiana Court of Appeal rejected this contention, however, since it found that the roads referred to by the defendants were in low-lying areas and were frequently impassable because of periodic flooding. Therefore, since the land was found to be enclosed, a legal servitude would generally be taken where the distance is shortest to the public road. This general rule was found to be inapplicable in this case since the shortest route would often be impassable because of flooding. Consequently, the case was remanded for the trial court to determine the location of a passage of servitude least injurious to the defendants and to determine the proper compensation the plaintiff should pay for the servitude. (Hoffman-Florida)  
W76-07904

#### UNITED STATES V. CALIFORNIA (RECLAMATION ACT REQUIREMENT OF CONFORMITY WITH STATE LAWS).

403 F. Supp. 874-903 (Ed Cal. 1975). 30 p.

Descriptors: \*California, \*Water permits, \*Federal Reclamation Law, \*Unappropriated water, \*Federal-state water rights conflicts, Reclamation, Legal aspects, Prior appropriation, Jurisdiction, Administration, Administrative agencies, Environmental effects, Permits, Water resources, State jurisdiction, Judicial decision, United States.

Plaintiff United States contended that the Reclamation Act authorized it to appropriate, for use in a federal reclamation project, unappropriated water within the State of California without applying to the California State Water Resources Control Board. Defendant State contended that the approval of the Board was required since the Act requires that the United States comply with all

terms and conditions for the issuance of state water permits. The defendant also contended that this permit compliance is mandated by the National Environmental Policy Act (NEPA). The District Court held that the United States must make an application to the state Control Board in order to determine the availability of unappropriated waters and to give the defendant notice of the scope of the project. The court also found, however, that the United States was required by the Reclamation Act to comply only with state procedural law and not with the substantive law. Thus a state must issue unconditional permits to the United States if unappropriated waters are available. As to the NEPA contention, the court found that the Act was not intended to establish a policy of state control of the environmental aspects of federal reclamation projects nor to give states the authority to place restrictions or conditions on any water permits issued. Summary judgement was then given for the United States. (Hoffman-Florida)  
W76-07905

#### POTOMAC RIVER ASSOCIATION V LUNDBERG MARYLAND SEAMANSHIP SCHOOL, INC. (PERMITS UNDER RIVERS AND HARBORS APPROPRIATIONS ACT).

402 F Supp 344-59 (D MD 1975). 16 p.

Descriptors: \*Dredging, \*Navigable waters, \*Commercial fishing, \*Damages, \*Permits, Streams, Navigation, Channel improvement, Judicial decisions, Legal aspects, Channels, Industrial wastes, \*Maryland, Landfills, Costs, Environmental effects.

Identifiers: Tort liability, Navigational capacity.

Plaintiff citizen organizations sought damages against defendant corporation arising out of the corporation's dredging and filling of land along a navigable creek. The plaintiffs alleged that these activities obstructed the navigational capacity of the creek and did substantial harm to the marine environment of the area. The defendant responded that it was not liable since it had acquired a valid permit from the Army Corps of Engineers before any work had begun. The court agreed that the defendant was protected for any actions it took pursuant to the permit, even if that permit had been improperly issued. However, the court held that corporate activities outside the scope of the permit would give rise to a cause of action for damages. Thus, commercial fisherman could bring an action for maritime tort if they could show injury to fish caused by corporate activities not authorized by the permit. The citizen organizations could also maintain suits based on obstruction of the creek's navigational capacity. (Hoffman-Florida)  
W76-07906

#### AMERICAN MEAT INSTITUTE V. EPA ('EFFLUENT LIMITATIONS' ON SLAUGHTERHOUSES UNDER THE FEDERAL WATER POLLUTION CONTROL ACT).

526 F2d 442-67 (7th Cir 1977). 26 p.

Descriptors: \*Water quality standards, \*Effluents, \*Sewage lagoons, \*Waste treatment, Sewage treatment, Water quality control, Regulation, Temperature, Ammonia, Thermal pollution, Technology, Classification, Standards, Legislation, Judicial decisions, Feed lots.

Identifiers: Slaughterhouses wastes, Packing houses, Effluent limitations.

Plaintiff meat institute sought a review of Environmental Protection Agency (EPA) regulations which set forth effluent limitations pertaining to certain substances used by slaughterhouses and packinghouses. Plaintiff contended that seasonal and climatic effects would prevent the achievement of the 1977 effluent limitations set down by the EPA pertaining to the three-lagoon system of waste treatment. This contention was rejected by the court, which found that winter and summer

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temperatures would not render the limitations unattainable by designated 1977 technology. The court then addressed the plaintiff's contention that the 1977 limitations were arbitrary and capricious. The court found that, with the exception of TSS limitations for complex slaughterhouses, the limitations were based on reliable and well-reasoned evidence. With one exception, the same conclusions were also reached as to 1983 limitations. The one exception was that the 1983 technology pertaining to ammonia limitations was found to be unfeasible, thus invalidating 1983 effluent limitations based on that technology. In sum, all of the EPA regulations were upheld on review except for the 1977 and 1983 TSS limitations for complex slaughterhouses and the 1983 ammonia limitations. (Hoffman-Florida) W76-07907

#### NATIONAL RESOURCES DEFENSE COUNCIL V. CALLAWAY (FEDERAL WATER POLLUTION CONTROL ACT).

524 F2d 79-97 (2d Cir 1975). 19 p.

Descriptors: \*Waste dumps, \*Environmental effects, \*Dredging, \*Federal Water Pollution Control Act, \*Federal jurisdiction, Waste disposal, Water pollution sources, Solid wastes, Legislation, Landfills, Standards, Administrative agencies.

Identifiers: Environmental impact statements.

Plaintiff environmental groups brought this action seeking to enjoin the Navy from dumping highly polluted dredged spoil into a Connecticut dumping site. Plaintiffs raised three contentions at the trial court: (1) the dumping permit issued to the Navy by the Army Corps of Engineers was in violation of the Federal Water Pollution Control Act (FWPCA); (2) the Corps and not the Navy should have prepared the environmental impact statement (EIS); and (3) that even if the Navy was the proper author, the EIS contained inadequate information. The trial court rejected these contentions, however, finding that it had no jurisdiction under the FWPCA, and finding that the Navy was the proper author of an adequate EIS. On appeal, the court found that the FWPCA provision requiring that the defendants be given a 60 day waiting period after notice of the violation before private suits could be brought was not a jurisdictional prerequisite to suit under the FWPCA. Thus the court had jurisdiction. Although the court found the Navy to be the proper author of the EIS, it found the statement to be in violation of statutory standards since it did not discuss the cumulative effect the dumping would have on surrounding areas, and did not adequately discuss alternative sites. The case was therefore reversed in part and remanded for further consideration. (Hoffman-Florida) W76-07908

#### GRIMBLE V. RAPIDES PARISH POLICE JURY (LACK OF VALID RIGHT OF WAY DEED RESULTING IN INVALID DRAINAGE EASEMENT).

322 So 2d 835-39 (La. Ct App 1975). 5 p.

Descriptors: \*Louisiana, \*Canals, \*Damages, \*Eminent domain, \*Flooding, \*Penalties(Legal), Legal aspects, Adjacent landowners, Real property, Costs, Crops, Flood damage, Constitutional law.

Plaintiff landowner brought this action against defendant police jury for damages resulting from the construction of a canal across his land, and for the value of the property so appropriated. The trial court awarded plaintiff only \$300 damages and the plaintiff appealed, contending that the canal, which was dug in 1950 without valid authorization, had caused flooding of his land for over twenty years. Plaintiff was thus seeking \$21,000 in damages, alleging that the flooding resulted in a crop loss of \$1,000 a year. The court rejected this

claim, however, holding that a landowner who had knowledge of the taking is entitled to recover the value of the property computed as of the date of taking. In this case, the value of the land in 1950 was \$300 per acre. Since the land taken comprised only .37 of an acre, the plaintiff should only have been awarded \$110. However, since the defendant had not appealed the \$300 judgement was allowed to stand. (Hoffman-Florida) W76-07909

#### COMMONWEALTH V. WASHINGTON TOWNSHIP (PA. CLEAN STREAMS LAW).

344 A2d 456-57 (Pa. 1975). 2 p.

Descriptors: \*Streams, \*Pennsylvania, \*Judicial decisions, \*Water quality control, \*Penalties(Legal), Legal aspects, Water law, State governments, Local governments, Governmental interrelations, Legislation, Water pollution, Water quality, Water pollution control.

Identifiers: Pennsylvania Clean Streams Law.

Petitioner Commonwealth of Pennsylvania sought an order to compel respondent municipality to comply with final orders of the Department of Environmental Resources made pursuant to Pennsylvania's Clean Streams Law. The respondent contended that a section of the Clean Streams Law provided for a sanction for contempt of court if a municipality failed to comply with an order and that, therefore, all other judicial remedies were precluded by the Law. The Supreme Court of Pennsylvania held that the language of the Clean Streams Law did not preclude judicial remedies other than a contempt sanction. Thus, an order requiring compliance with the orders of the Department of Environmental Resources was an appropriate remedy under the statute. (Nursery-Florida) W76-07910

#### SCHWEND V. JONES (WATER RIGHTS REPRESENTED BY WATER STOCKS PASS BY CONTRACT FOR DEED).

515 P2d 89-91 (Mont. 1973). 3p.

Descriptors: \*Montana, \*Riparian rights, \*Land tenure, \*Relative rights, Legal aspects, Boundaries(Property), Adjacent land owners, Water law, Water rights, Judicial decisions, Legal review, State jurisdiction, Water utilization, Boundary disputes, Water rights, Real property.

The plaintiffs, purchasers under contract for deed to farmland, sought declaratory judgement determining ownership of water rights between purchaser and seller. The written contract for deed described the land but did not refer to hereditaments, appurtenances, or water rights. The water rights were evidenced by shares of stock in a ditch company. The plaintiffs' claim for relief was founded on the belief that such water rights were appertaining to the land and, therefore, passed with it. The defendant filed a general denial and claimed res judicata. The trial court entered judgement for the plaintiffs and the Supreme Court of Montana affirmed, holding that the water rights were appertaining to the land sold. Thus the contract for deed effectively conveyed ownership in absence of an express reservation. (Griffith-Florida) W76-07911

#### DOUGHERTY V. CALIFORNIA-PACIFIC UTILITIES CO. (DAMAGE ASSESSMENT BECAUSE OF LACK OF DUE CARE IN CANAL WATERFLOW MANAGEMENT).

546 P2d 880-85 (Utah 1976). 6p.

Descriptors: \*Utah, \*Spillways, \*Cloudbursts, \*Flood damage, \*Ditches, Canals, Diversion structures, Public utilities, Electric powerplants, Negligence, Hazards, Floods, Flood protection, Real property, Legislation, Surface runoff.

Identifiers: Proximate causation.

Plaintiff homeowner brought action against defendant utility company for damages sustained when defendant's canal overflowed and flooded plaintiff's property. The defendant's canal was situated on a hillside with plaintiff's property downhill. The overflow occurred during a severe rainstorm. While the canal was equipped with water flow controls, none was employed to prevent the overflow. The plaintiff alleged negligence in failure to prevent flooding while the defendant argued that the storm water was an 'act of God'. The trial court entered judgement for the plaintiff. The Utah Supreme Court affirmed in a split opinion. Utah statutes impose a duty on water diverters to prevent damage to others' property. The standard of care imposed is reasonable care under the circumstances. Due to the dangers inherent in water control, management should be accomplished with skill and expertise. If the storm was reasonably foreseeable or if action could have been taken once the magnitude was recognized, failure to use canal flow devices constituted a breach of duty and was the proximate cause of the flood damage. (Comer-Florida) W76-07912

#### BRAVERMAN V. EICHER (MODIFIED CIVIL LAW RULE OF SERVIENT TENEMENT TO NATURAL DRAINAGE).

238 NW2d 331-39 (Iowa 1976). 9p.

Descriptors: \*Iowa, \*Surface drainage, \*Civil law, \*Surface runoff, \*Natural flow doctrine, Relative rights, Alteration of flow, Artificial flow, Erosion, Landscaping, Buildings, Penalties(Legal), Land fills, Adjacent landowner, Reasonable use.

Identifiers: Nuisance(Legal aspects), Evidence, Injunctive relief.

Plaintiff servient estate owner brought action against defendant dominant estate owner for damages and injunctive relief pertaining to an alleged drainage nuisance. The defendant counter-claimed asking for a mandatory injunction requiring that a restraining wall be constructed. The trial court awarded plaintiff damages, denied injunctive relief to either party and required both parties to share the cost of constructing a retaining wall. The Iowa Supreme Court affirmed. Iowa applies the modified civil law rule under which a servitude of natural drainage exists between adjoining lands which servient estate owner must accept. The dominant estate owner may incur liability, however, for altering the natural system of drainage and thereby substantially increasing the servient estate burden. Liability may also be incurred for removal of lateral support from adjoining land and for improper land filling which allows earth to pass or slide onto adjoining land. In this case, the Court found that sufficient evidence had been introduced to support an attendant monetary award for damages caused to plaintiff's land. The court refused to award exemplary damages for drainage nuisance, however, since no actual or legal malice had been shown. (Comer-Florida) W76-07913

#### STEFFEN V. COUNTY OF CUMING (FLOODING DAMAGES TO CROPS).

238 NW2d 890-94 (Neb. 1976). 5p. 1 map.

Descriptors: \*Nebraska, \*Water injury, \*Crop response, \*Damages, \*Ditches, Irrigation ditches, Diversion structures, Flooding, Surface drainage, Flood protection, Remedies, Obstruction to flow, Crops, Local governments, Value.

Identifiers: Injunctive relief, Proximate causation.

Plaintiff landowner brought action requesting an injunction and damages against defendant township. The plaintiff's pasture was bordered by a man made ditch which carried runoff water from a nearby creek. The ditch runs into another ditch maintained by defendant township. The second ditch flows into another nearby creek. After the township cleaned and widened the second ditch,

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the plaintiff alleged that the cleaning caused runoff water to flood his pastureland. The trial court denied relief and the Nebraska Supreme Court affirmed holding that the measure of damages is the difference between the value of the land before the damage and the value of the land after damage. Since plaintiff failed to introduce evidence establishing these values, the Court had no bases on which to award compensable damages. The Court also found injunctive relief to be unavailable since no evidence was introduced establishing that the widening changed the water diversion in amount or source. (Comer-Florida)  
W76-07914

#### MOBIL OIL CORP. V. TOWN OF HUNTINGTON (CONSTITUTIONALITY OF OIL SPILLAGE ORDINANCE).

380 NY 52d 466-76 (Sup. Ct. 1975) 11p.

Descriptors: \*New York, \*Oil spills, \*Legislation, \*Permits, \*Navigable waters, Ships, Transportation, Docks, Oil industry, Natural gas, Oil pollution, Oil wastes, Storage tanks, State governments costs.

Plaintiff oil distribution terminal sought a declaration of invalidity of defendant municipality's oil spillage ordinance. The ordinance requires a permit grant for transfer of more than 600 gallons of liquid fuel or oil with permit issuance predicated upon specific safety equipment installation. A fee imposed on fuel transferred by terminal operators finances a spill prevention and clean up fund. On motions for dismissal by the defendants the court found the ordinance consistent with federal law, interstate commerce and admiralty jurisdiction. The court also found the law within the statutory enactment power of the town. While rejecting the plaintiff's allegations of vagueness and indefiniteness, the court remanded the case for a re-determination of fact issues. (Comer-Florida)  
W76-07915

#### STATE V. BUNDRANT (STATE REGULATION OF SEDIMENTARY MARINE LIFE ON OUTER CONTINENTAL SHELF NOT PRE-EMPTED BY SUBMERGED LANDS ACT OR OUTER CONTINENTAL SHELF LANDS ACT).

546 P2d 530-64 (Alas. 1976). 35p.

Descriptors: \*Alaska, \*Crabs, \*Continental shelf, \*Federal jurisdiction, \*State jurisdiction, Marine fisheries, Jurisdiction, Treaties, Submerged Lands Act, Regulation, Law enforcement, State governments, Constitutional law, Legislation, Marine animals.

Identifiers: Territorial seas(Jurisdiction), Outer Continental Shelf Lands Act.

Plaintiff state charged defendant fishermen with criminal violation of various state statutes and regulations relating to crabbing in the Bering Sea. Since the alleged violations took place outside of the three mile territorial sea limit, the fishermen contended that the plaintiff had no jurisdiction over their actions. Furthermore, they contended that when Congress enacted the Submerged Lands Act, it conferred exclusive federal jurisdiction over fishery regulation beyond the three mile limit. The Alaska Supreme Court held for the plaintiff and made the following findings: (1) fishery regulation in the Bering Sea beyond the three mile limit was not under exclusive federal jurisdiction; (2) neither of the two Acts had preempted state regulation of sedimentary marine life on the outer Continental shelf; and (3) the state had the power to bring criminal action against the defendants. (Lasris-Florida)  
W76-07916

#### JIVELEKAS V. CITY OF WORLAND (WHAT CONSTITUTES DAMAGES BY BLOCKED SEWER LINE).

546 P2d 419-34 (Wyo. 1976). 26p.

Descriptors: \*Wyoming, \*Sewers, \*Overflow, \*Damages, \*Negligence, Cities, Pipelines, Accidents, Legal aspects, Risks, Pipes, Design standards, Public utilities, Treatment facilities, Governments, Planning, Backwater, Judicial decisions.

Identifiers: \*Sovereign immunity.

Plaintiff homeowners sought damages from defendant city for damage caused to their homes by a sewer back-up which allegedly occurred as a result of defendant's negligent planning, construction and maintenance of a sewer line. The defendant contended that it was not negligent, and that even if it was, such negligence was not a proximate cause of the purported damage. The plaintiffs' sole proof was that a better sewer line could have been installed and that the sewer line in question had become plugged with resulting damage to their property. The Wyoming Supreme Court noted that uncontradicted expert testimony on defendant's behalf demonstrated that the sewer line was adequate and that the plugging of sewer lines might occur even though due care is exercised in their construction, design and maintenance. Since the plaintiffs had failed to connect any alleged negligence of the defendant with the damages claimed, the judgement for the defendant was affirmed. (Lasris-Florida)  
W76-07917

#### BRIGGS V. GOLDEN VALLEY LAND AND CATTLE CO. (THE FIXING OF ANNUAL WATER RIGHTS ASSOCIATED WITH VARIOUS GROUNDWATER LICENSES).

546 P2d 382-91 (Idaho 1976). 10p, 1 tab.

Descriptors: \*Idaho, \*Bank storage, \*Aquifer management, \*Aquifers, \*Groundwater mining, Groundwater, Water storage, Storage, Groundwater recharge, Natural recharge, Groundwater resources preferences(Water rights), Jurisdiction, Judicial decisions, Permits, Legal aspects, Available water-recharge, Constitutional law.

Identifiers: Water rights(Non-riparian), Administrative regulations.

Plaintiff groundwater users appealed an order of defendant, director of Department of Water Administration, fixing annual water rights associated with groundwater licenses. The director's order modified a previous court order which set a maximum yearly amount of water that could be pumped from the aquifer. The plan allowed water users to 'bank' the difference between the amount used in one year and the maximum amount allowed per year. The 'banked' water could then be withdrawn in a later year if necessary. The trial court held that the director had no authority to modify the prior court order. On appeal to the Supreme Court of Idaho, the defendants argued that the plaintiff's appeal to the district court had not been perfected under the Administrative Procedure Act. The Supreme Court agreed but was unable to determine whether the appeal was properly commenced under an alternative method and remanded to the district court for such a determination. In so doing, the court pointed out that the 'banking' plan was within defendant director's power to implement so long as he found that 'mining' of the aquifer would not result. (Lasris-Florida)  
W76-07918

#### STATE DEPARTMENT OF ENVIRONMENTAL RESOURCES V METZGER (JUSTIFICATION OF SEWER REGULATIONS: MERE POSSIBILITY OF WATER POLLUTION).

347 A2d 743-46 (Pa. Com. Ct. 1975). 4 p.

Descriptors: \*Pennsylvania, \*Sewage disposal, \*Groundwater, \*Regulation, Environmental control, Sewage, Water pollution, Legal aspects, Governments, Standards, Judicial decisions, Treatment facilities, Water pollution control, State governments.

Identifiers: \*Tidal wetlands.

Plaintiff applicant sought a permit to install a sewage disposal system. Defendant state agency refused to grant the permit because the plaintiff had not proved compliance with regulations existing at the time of adjudication. The plaintiff contended that those regulations were not in effect when he filed for the permit and, therefore, he should not be required to adhere to them. Alternatively, the plaintiff argued that any regulations prohibiting his system, which he alleged would cause no pollution, were unreasonable and would constitute an unlawful exercise of police power. The Commonwealth Court of Pennsylvania held that the plaintiff was required to comply only with the regulations in effect at the filing of his application. Nevertheless, the court affirmed the decision since the plaintiff had failed to comply with those existing regulations. As to the alternative argument, the court held that a mere possibility that pollution could result from the installation of a proposed sewage system was enough to justify the regulation. (Lasris-Florida)  
W76-07919

#### TORTOLANO V DIFILIPPO (INJUNCTION TO STOP WATER FLOW ACROSS PROPERTY).

349 A2d 48-53 (RI 1975). 6 p, 1 map.

Descriptors: \*Rhode Island, \*Adjacent land owners, \*Retaining walls, \*Alteration of flow, \*Diversion, Legal aspects, Compaction, Land forming, Erosion, Erosion control, Slopes, Natural flow doctrine, Surface waters, Surface runoff, Landslides, Mudflows, Debris avalanches, Damages, Judicial decisions.

Identifiers: Common enemy rule, Injunctive relief.

Plaintiff landowners sought to enjoin defendant owner of adjoining land from allowing debris from the defendant's property to be carried by storm water onto the plaintiffs' property. The plaintiffs further sought to require the defendant to install and maintain a retaining wall for lateral support and to pay damages to restore the plaintiffs' premises to their original condition. The plaintiffs owned a lot downhill from and abutted on two sides by the defendant's property. The defendant deposited large amounts of loose fill on his property significantly increasing its natural steep grade. The plaintiffs contended that the surface waters diverted to their land by the change in grade carried large quantities of loose fill onto their property causing damage. The defendant argued that the common enemy doctrine regarding surface waters should control. The trial court granted the injunctions and damages sought by the plaintiffs holding that where the defendant had created the situation by elevating his property above the natural grade, he had an affirmative duty to prevent the fill from sliding onto the plaintiffs' adjoining lot. The Supreme Court of Rhode Island affirmed, noting that the common enemy doctrine did not apply in this case. (Capehart-Florida)  
W76-07920

#### LEHAN V STATE DEPARTMENT OF TRANSPORTATION (SEWAGE POLLUTION OF LANDOWNER'S WELL NOT A TAKING UNDER EMINENT DOMAIN CODE).

349 A2d 492-93 (Pa. Com. Ct. 1975). 2 p.

Descriptors: \*Pennsylvania, \*Eminent domain, \*Sewage, \*Ditches, \*Water pollution, Drainage, Drains, Highways, State governments, Administrative agencies, Runoff waters, Adjacent property owners, Trespass, Legal aspect, Judicial decisions, Water pollution sources, Sewage effluents, Damages, Wells.

Identifiers: De factotaking, Injunctive relief.

Plaintiff landowners brought action for compensation from defendant state agency under the eminent domain code. The defendant maintained an earthen ditch along the plaintiffs' property to carry runoff water from a highway. The plaintiffs' neighbors discharged sewage and other waste

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materials into the defendant's drain which emptied into the ditch. As a result, the plaintiffs' well and property were polluted. The plaintiffs were denied injunctive relief against the neighbors. The plaintiffs contended that the defendant had effected a de facto taking of their property by permitting introduction of sewage into the drainage system, thereby producing damage to the property. The trial court held that the plaintiffs had stated a proper cause of action. The Commonwealth Court of Pennsylvania reversed, dismissing the action. That court held that the injury was not the direct and unavoidable consequence of the defendant's conduct and therefore did not constitute a de facto taking. The court said that redress for injuries resulting from improper conduct by third parties would have to be sought in a trespass action against those parties. (Capehart-Florida) W76-07921

**BD OF ED V STATE DEPT OF TRANSP (RAILROAD LIABILITY FOR FLOODING CAUSED BY PIPELINE'S INABILITY TO HANDLE INCREASED WATER VOLUME),** 351 A2d 17-22 (NJ 1976). 6 p.

Descriptors: \*Drainage effects, \*New Jersey, \*Railroads, \*Obstruction to flow, \*Floods, Drains, Pipes, Streams, Upstream embankments, Watersheds(Basins), Bulkheads, Structures, Natural flow, Dams, Relative rights, Reasonable use, Culverts, Surface drainage, Legal aspects, Judicial decisions, Administrative agencies, State governments.

Identifiers: Injunctive relief, Common enemy rule.

Plaintiff board of education sought to enjoin defendant department of transportation and defendant railroad to abate a nuisance. Prior to 1920, the defendant had installed a 24-inch drainage pipe to allow a stream draining a 735-acre watershed to pass under a railroad embankment. Development in the area had rendered the pipe inadequate resulting in the periodic flooding of two schools maintained by the plaintiff. The plaintiff contended that flooding would be reduced by removal of a bulkhead installed by the defendant. The plaintiff further contended that significant alleviation of the general flooding problem would only be accomplished by improvement of the railroad culvert. The defendant railroad contended that the upstream owner had no cause of action for interference with a stream by a downstream owner. The trial court required the railroad to construct new drainage facility. In affirming, the Supreme Court of New Jersey held that obstructions of water courses have a continuing duty to accommodate their structures to the passage of such increasing volume of waters as is attendant upon area development so as not to visit flood damage upon others. (Capehart-Florida) W76-07922

**STATE DEPT. OF ENVIRONMENTAL PROTECTION V. JERSEY CENTRAL PWR AND LIGHT CO. (NO LIABILITY FOR DISCHARGE OF UNHEATED WATER INTO STREAM BECAUSE SUCH WATER NOT PROXIMATE CAUSE OF DEATH OF FISH),** 351 A2d 337-45 (NJ 1975). 9 p, 2 tab.

Descriptors: \*New Jersey, \*Nuclear powerplants, \*Fishkill, \*Water cooling, \*Thermal pollution, Electric power industry, Fish, Discharge(Water), Rivers, Streams, Heated water, Temperature, Water temperature, Water pollution sources, Regulation, Federal Government, State governments, Administrative agencies, Legal aspects, Federal jurisdiction.

Identifiers: \*Menhaden, Proximate causation, Strict liability.

Plaintiff state department of environmental protection sought penalties and damages from defendant-public utility for fish kills allegedly caused by the operation of its nuclear power plant located

between two rivers. Water from one river was run through the plant for cooling and then discharged in a heated state into the other river. In January, 1972, the plant was temporarily shut down and the second stream was no longer heated. Subsequently, menhaden fish living in the heated stream died when water temperatures fell below 39 degrees. Plaintiff contended that the defendant violated a New Jersey statute prohibiting the introduction of destructive substances into fresh waters when it pumped cold water into the warm stream. The trial court held the defendant liable for damages under strict liability for an ultra-hazardous situation. The appellate court found liability for negligence. The Supreme Court of New Jersey reversed, holding that the plaintiff had failed to establish a violation of the statute and that the pumping was not the cause in fact of the fish kill. The court further held that the defendant was subject to federal, rather than state, regulations. (Capehart-Florida) W76-07923

**SMITH COVE ASS'N V. SPECIAL BD (PROCEDURE FOR REMOVAL OF WHARVES AND PIERS),** 352 A2d 726-28 (NH 1976). 3 p.

Descriptors: \*New Hampshire, \*Piers, \*Jurisdiction, \*Administrative agencies, Beds, Docks, Land tenure, Ownership of beds, Judicial decisions, Legal review, Legal aspects, Structures, Lakes, Lake beds, High water mark, Permit, Regulation, Administrative decisions, Channels.

Identifiers: Writ of mandamus, Administrative regulations.

Plaintiff association sought a writ of mandamus compelling defendant board to request that the attorney general petition in court to order the removal of piers on co-defendant landowner property. The plaintiff contended that the landowner was required to obtain a grant from the governor and council since the piers were located below the mean high water level of a lake. The defendant landowner contended that the permit from the board was sufficient for his proposed changes in that part of the channel lying within the boundaries of his property. The trial court approved the master's recommendation for dismissal of the plaintiff's action. The Supreme Court of New Hampshire reversed and remanded a case for full fact finding on the issues. The court said it had not been established whether defendant landowner was properly authorized by the board, or whether a grant by the governor and council was required. The court stated that the board's jurisdiction depended on a determination of whether the piers were in public waters or in the bed of public waters before the landowner's shoreline. The court held that until the prescribed procedure for review was followed, no occasion for interpretation of the statute was presented. (Capehart-Florida) W76-07924

**MILLS V. MURPHY (ALTERATION OF FRESH WATER WETLANDS UNDER THE FRESH WATER WETLANDS ACT),** 352 A2d 661-74 (RI 1976). 14 p.

Descriptors: \*Alteration of flow, \*Rhode Island, \*Freshwater marshes, \*State jurisdiction, \*Water resources development, Land reclamation, Riparian rights, Legislation, Administrative agencies, Navigable water, Constitutional law, Public rights, Rivers.

Identifiers: \*Public trust doctrine, Licenses, Presumptions(Legal).

Plaintiff landowners brought an action to have the Rhode Island Fresh Water Wetlands Act declared unconstitutional on its face and to enjoin enforcement. The plaintiffs had attempted to relocate certain areas of a river passing through their lands. Under the Act, defendant director of Natural

Resources could respond to violations of the Act and, in conjunction with local municipalities refuse freshwater wetland alteration. The trial court granted the defendant's summary judgement motion. The Rhode Island Supreme Court affirmed, relying on the statute amended during appeal pendency. The court found the statements of policy contained within the Act and the Act's limitation to particular geographic areas represented adequate limitations on discretion. Furthermore, equal protection is not abridged unless plaintiff can show that saltwater wetlands owners and freshwater wetlands owners are similarly situated. (Comer-Florida) W76-07925

**STEPHENS V. BURTON (LIMITATIONS OF WATER APPURTENANT TO CONVEYED PROPERTY),** 546 P2d 240-42 (Utah 1976). 3 p.

Descriptors: \*Cattle, \*Utah, \*Spring waters, \*Withdrawal, \*Consumptive use, Water supply, Water users, Water yield, Boundaries(Property), Reasonable use, Relative rights, Legal aspects, Water rights, Irrigation water, Judicial decisions.

Plaintiff grantees brought an action to determine water rights in the flow of certain springs. The defendants owned certain property and the right to use the flow of water equally. One of the defendants had conveyed approximately one quarter of the acreage owned through two deeds. One of the deeds contained no mention of conveyance or reservation of water rights, while the other deed provided for the conveyance of stock water rights. A Utah statute provides that water rights appurtenant to lands shall pass to the grantee of such land except that reservation may be made in express terms so that water rights may be separately conveyed. If a water right has been exercised in irrigating different parcels at different times, only that amount of water which was used immediately preceding the time of conveyance is deemed appurtenant to the land conveyed. Since the trial court had determined the number of gallons per minute conveyed for watering cattle, the Supreme Court remanded, holding that water rights must be determined in relation to use prior to sale when water is used for irrigation or for stock watering purposes. (Comer-Florida) W76-07926

**MATTER OF APPLICATION FOR WATER RIGHTS OF PREISSER (AVAILABILITY OF WATER TO SUPPLY DEMANDS OF JUDICIAL DECREE),** 545 P2d 711-12 (Colo 1976). 2 p.

Descriptors: \*Rivers, \*Colorado, \*Water wells, \*Groundwater basins, \*Groundwater availability, Water sources, Groundwater movement, Water supply, Subsurface waters, Legal aspects, Judicial decisions, Priorities, Legal review.

Identifiers: Water rights(Non-riparians).

Appellee water supply contractors made application for a conditional decree awarding water wells. Appellant objectors alleged that the water was not available to supply the decree. The wells in question were located in the drainages of two creeks which were fed by water from a basin. The trial court determined that the water in the basin could not be administered as part of the Arkansas River because the water would not reach the river for a period of three hundred to eight hundred years. The trial court's decree, which allowed 14 wells to withdraw water not to exceed 8100 acre feet per year for irrigation, municipal, commercial, industrial, recreational, and other beneficial purposes, was affirmed by the Supreme Court of Colorado. That court held that the parties had conceded that if water were available to supply the decrees no other problem existed. There was sufficient evidence of availability on the record. (Comer-Florida) W76-07927

## WATER RESOURCES PLANNING—Field 6

### Nonstructural Alternatives—Group 6F

**UNITED STATES V ONE (1) 43 FOOT SAILING VESSEL WINDS WILL, LICENSE O. N. 531317/US AND EQUIPMENT (NO EXERCISE OF SOVEREIGNTY ON WATERS OF HIGH SEAS).**  
405 F. Supp. 879-84 (SD Fla. 1975). 6 p.

Descriptors: \*Federal jurisdiction, \*Coast Guard regulations, \*Law of the Sea, \*International law, Constitutional law, Boating regulation, Navigation, Oceans.

Identifiers: Territorial seas(Jurisdiction), Laches.

Plaintiff United States sought forfeiture of a sailboat which the Coast Guard had boarded for a safety check and found to contain marijuana. Coast Guard found ship on the high seas, running without lights at night. They boarded the ship for a routine safety inspection, and noticed strong smell of marijuana. The officers searched the ship and found 200 pounds. Defendant owner contends plaintiff should be barred by laches, that plaintiff had no jurisdiction over a vessel on the high seas, and that there was insufficient probable cause to uphold the search. The court found that no nation may exercise sovereignty over the waters of the high seas, and that only vessels of the United States Government may exercise jurisdiction over United States flag vessels. Here, the defendant was the party responsible for the decay in the proceedings, and forfeiture occurs at the moment of illegal use. The vessel here was of the United States and therefore subject to its jurisdiction. The bonding was for a safety inspection, therefore no probable cause needed. The marijuana was in plain view. (Edenfield-Florida)  
W76-07930

**THOMAS V. CLARK (GRANTING OF RIGHT TO TAKE WATER FROM LAND AS CONVEYING RIGHT IN THE LAND ITSELF).**  
346 A2d 189-91 (Vt. 1975). 3 p.

Descriptors: \*Vermont, \*Water rights, \*Real property, \*Spring waters, \*Developed waters, Springs, Confined water, Water utilization, Conscriptive use, Judicial decisions, Legal aspects, Reasonable use, Competing uses, Appropriation, Diversion, Water demand, Land tenure.

Plaintiff servient estate owners brought action against defendant dominant estate owner to determine spring rights. The spring rights originated in a warranty deed from a common grantor in both plaintiffs' and defendant's chain of title. No developed spring existed at the time but the spring in dispute was subsequently developed. After development the defendant asserted a use right. The trial court found for defendant and the Vermont Supreme Court affirmed, holding that the grant of right to take water from land conveys a right in land itself. When no developed spring existed at the time of grant of spring rights the dominant estate owner may use a subsequently developed spring as long as such use does not deprive servient estate owners of land use. Where it is determined that the dominant estate owner is entitled to use a spring developed solely by servient estate owner, the doctrine of unjust enrichment will not affect the use right even though contribution may be required. (Comer-Florida)  
W76-07939

**SPINDOR V LO-VACA GATHERING COMPANY (FORESEEABLE FILL-IN OF LAKE RELEVANT IN DETERMINING REMAINDER DAMAGES IN EMINENT DOMAIN).**  
529 SW2d 63-67 (Tex. 1975). 5 p.

Descriptors: \*Texas, \*Eminent domain, \*Surface waters, \*Condemnation, \*Lakes, Legal aspects, Right-of-way, Water pollution, Cost repayment, Value, Economics, Compensation, Economic impact, Lake basins, Lake sediments, Water pollution sources.

Petitioner land buyers were awarded compensation action brought against the respondent condemnor. The petitioners contended that during construction of a pipeline across their lake property the respondent also built a road which subsequent heavy rains washed out. This washout allegedly caused dirt to be spread throughout the lake bottom. The respondent objected to the trial court's damage award, however, contending that the expert testimony given as to the cost to restore the lake after the wash out was inadmissible. The Supreme Court of Texas held that the damage to the lake was foreseeable and should be taken into account when determining damages for diminution in value of the petitioners' remainder (lake). Since the damages were foreseeable, evidence of the damages was relevant to the condemnation proceeding. Thus, the evidence of estimated costs to restore the lake was for the jury's consideration in fixing the amount of foreseeable damages in the condemnation proceeding.  
W76-07930

**WITTER V. COUNTY OF ST. CHARLES (MAN-MADE AVULSION CAUSING NO CHANGE IN COUNTY BOUNDARY LINE).**  
528 SW2d 160-62 (Mo. Ct. App. 1975). 3 p.

Descriptors: \*River flow, \*Boundary disputes, \*Islands, \*Accretion(Legal aspects), \*Missouri River, Regulated flow, Channels, Stream flow, Dams, Dam construction, Dikes, River regulation, Regulation, Legal aspects, Boundaries(Property), Water law, Avulsion, Judicial decisions, Channel flow, Missouri.

Identifiers: Navigation obstructions.

Plaintiff island owner brought a declaratory judgment action against defendant county to determine in which of two bordering counties the island was located. The island had been defined as being in St. Charles county until the main river channel had been altered by construction of a dike built adjacent to the downstream end of the island. The main channel was sealed off and shifted to the north side of the island. The previous boundary between the counties had been defined as "the middle of the main channel" so that now both counties had assessed taxes against the plaintiff. The Missouri Court of Appeals held that changes caused by accretion could move the boundary line with the shifting but that changes caused by avulsion could not move a boundary line. Since the legal effect of a change by governmental construction is as if the change were caused by an avulsion, the boundary line of the island was found to be the same as it was prior to construction. (Welch-Florida)  
W76-07931

**CITY OF HAWKINSVILLE V CLARK (RIGHT OF PROPERTY OWNER TO DIG A WELL).**  
219 SE2d 577-79 (Ga Ct App 1975). 3 p.

Descriptors: \*Real property, \*Georgia, \*Well permits, \*Wells, \*Constitutional law, Legal aspects, Permits, Regulation, Drilling, Water permits, Sub-surface waters, Water law, Public rights, Governments, Judicial decisions, Legal review, Shafts(Excavations), Excavation, Construction, Well regulations.

Defendant land owner was convicted of violating an ordinance which prohibited the digging of a well of any kind without obtaining permission of the Board of Commissioners. The Superior Court held the ordinance unconstitutional and plaintiff city appealed. The plaintiff contended that the ordinance was a valid exercise of its police power to protect the health and welfare of its citizens. The Court of Appeals of Georgia held that while the plaintiff may make reasonable rules and regulations to protect the health and safety of its citizens, the grant or refusal of a permit to dig upon one's own property cannot be left to the arbitrary discretion of the board. Since the or-

dinance prescribed no rules by which it was to be executed impartially and since it did not give an applicant for a permit an opportunity to be heard concerning his application, the ordinance was found to be unconstitutional. The Court noted that when property rights are involved, due process requires a hearing as a matter of right. (Welch-Florida)  
W76-07932

**MCCAULEY V PHILLIPS (NO LIABILITY FOR FLOODING OF LOWER LAND RESULTING FROM NON-NEGIGENT UPPER LAND IMPROVEMENTS).**  
219 SE2d 854-59 (Va 1975). 6 p.

Descriptors: \*Negligence, \*Virginia, \*Surface runoff, Rainfall-runoff relationships, \*Land development, Discharge(Water), Excess water(Soils), Flood discharge, Flow, Overland flow, Rainfall, Running waters, Runoff forecasting, Slopes, Surface waters, Precipitation intensity, Drainage systems, Drainage effects, Drainage water, Damages, Legal aspects, Judicial decisions, Impact(Rainfall).

Identifiers: Injunctions(Prohibitory), Injunctive relief.

Plaintiff lower landowners brought this action to enjoin defendant upper landowners from channelling surface water through a discharge pipe onto lower lands and to recover damages arising from the flooding of the lower lands. The Circuit Court denied relief and the plaintiffs appealed, contending that such denial was an abuse of the judge's discretion. The defendants contended that no abuse of discretion had occurred since the improvements made upon their upper lands were not made negligently and since the surface water runoff naturally flowed upon the plaintiff's lands. The Supreme Court of Virginia held that no greater damage occurred to the plaintiffs' lands than would have naturally; therefore, no liability would be imposed solely because there was an artificial drainage system present. The court also found that the denial of an injunction was not an abuse of the judge's discretion where such an injunction would have rendered the defendants' main building unusable while not affording relief to the plaintiffs. Since improvements made by the defendants were not negligent and the water discharge was not malicious, the defendants were not liable for damages resulting from such improvements. (Welch-Florida)  
W76-07933

#### OPTIONS FOR COST SHARING: COST SHARING ISSUES-DIMENSIONS, CURRENT SITUATION AND OPTIONS.

Water Resources Council, Washington, D.C.  
For primary bibliographic entry see Field 6C.  
W76-08035

### 6F. Nonstructural Alternatives

**TYPE 16 FLOOD INSURANCE STUDY: TSUNAMI PREDICTIONS FOR MONTEREY AND SAN FRANCISCO BAYS AND PUGET SOUND.**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

A. W. Garcia, and J. R. Houston.

Available from the National Technical Information Service, Springfield, Va., 22161, as AD-A018 421, \$9.00 in paper copy, \$2.25 in microfiche. Technical Report H-75-17, November 1975. 263 p., 240 fig, 2 tab, 13 ref, append.

Descriptors: \*Forecasting, \*Flood forecasting, \*Tsunamis, California, Washington, Bays, Flood plain insurance, Insurance.

Identifiers: \*Flood insurance, \*Monterey Bay(Cal), \*Puget Sound(Wash), \*San Francisco Bay(Cal).

## Field 6—WATER RESOURCES PLANNING

### Group 6F—Nonstructural Alternatives

Calculations of runup due to seismic sea waves (tsunamis) of distant origin were made for Monterey and San Francisco Bays and the greater part of Puget Sound. Those areas which are specifically included and excluded are listed. The values presented are interpreted as being equalized or exceeded on the average of once per 100 (R100) or once per 500 (R500) yr, whichever is indicated. All runup values, R100 and R500, are referenced to the mean sea level datum. The combined effects of astronomical tides and tsunamis are incorporated into the analysis as are certain local effects. The effects of wind waves superimposed on the tsunami have been neglected. The simultaneous occurrence of a storm surge and tsunami is considered highly improbable and therefore unlikely to constitute a 1 in 100- or 1 in 500-yr event. Analysis of the error attributed to each of the various steps in the procedure results in an estimated maximum average error of about plus or minus 40 percent. (WES)  
W76-07456

**ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07564

**FLOOD PLAIN INFORMATION: CLINTON RIVER AND PAINT CREEK, OAKLAND COUNTY, MICHIGAN.**  
United States Lake Survey, Detroit, Mich.  
For primary bibliographic entry see Field 4A.  
W76-07720

**FLOOD PLAIN INFORMATION: NORTH YUBA AND DOWDIE RIVERS, DOWNIEVILLE, CALIFORNIA.**  
Army Engineer District, Sacramento, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07721

**FLOOD PLAIN INFORMATION: ROCK RIVER-POPLAR CREEK, LUVERNE AND VICINITY, MINNESOTA.**  
Army Engineer District, Omaha, Nebr.  
For primary bibliographic entry see Field 4A.  
W76-07722

**FLOOD PLAIN INFORMATION: KETTLE CREEK, WAYCROSS AND WARE COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07723

**FLOOD PLAIN INFORMATION: HURRICANE CREEK, ALMA AND BACON COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07724

**FLOOD PLAIN INFORMATION: LITTLE CRAB ORCHARD CREEK AND PILES FORK CREEK, CARBONDALE, ILLINOIS.**  
Army Engineer District, St. Louis, Mo.  
For primary bibliographic entry see Field 4A.  
W76-07725

**FLOOD INSURANCE STUDY: PLEASANTON, ALAMEDA COUNTY, CALIFORNIA, (PRELIMINARY REPORT),**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07726

**FLOOD PLAIN INFORMATION: MINNESOTA RIVER AND TRIBUTARIES, MANKATO, NORTH MANKATO, LE HILLIER.**  
Army Engineer District, St. Paul, Minn.  
For primary bibliographic entry see Field 4A.  
W76-07727

**FLOOD PLAIN INFORMATION: GRAND RIVER, GRAND RAPIDS, MICHIGAN AND VICINITY.**  
United States Lake Survey, Detroit, Mich.  
For primary bibliographic entry see Field 4A.  
W76-07728

**FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER-SAUK RIVER-WATAB RIVER, VICINITY OF ST. CLOUD, MINNESOTA.**  
Army Engineer District, St. Paul, Minn.  
For primary bibliographic entry see Field 4A.  
W76-07729

**FLOOD PLAIN INFORMATION: YALOBUSHIA RIVER AND TRIBUTARIES, GRENADA, MISSISSIPPI.**  
Army Engineer District, Vicksburg, Miss.  
For primary bibliographic entry see Field 4A.  
W76-07730

**FLOOD PLAIN INFORMATION: CEDAR CREEK, ATHENS AND CLARKE COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07731

**FLOOD PLAIN INFORMATION: FRESNO RIVER AND COTTONWOOD, LITTLE DRY, AND ROOT CREEKS, MADERA, CALIFORNIA.**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07732

**FLOOD PLAIN INFORMATION: MILL SLOUGH, OSCEOLA AND ORANGE COUNTIES, FLORIDA.**  
Army Engineer District, Jacksonville, Fla.  
For primary bibliographic entry see Field 4A.  
W76-07733

**FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, LOVELAND, COLORADO.**  
Army Engineer District, Omaha, Nebr.  
For primary bibliographic entry see Field 4A.  
W76-07734

**FLOOD PLAIN INFORMATION: NORTH FORK REPUBLICAN RIVER, WRAY, COLORADO.**  
Army Engineer District, Kansas City, Mo.  
For primary bibliographic entry see Field 4A.  
W76-07735

**NATIONAL FLOOD INSURANCE ACT--1975.**  
For primary bibliographic entry see Field 6E.  
W76-07868

**STORM DRAINAGE AND URBAN REGION FLOOD CONTROL PLANNING,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08086

**PROBLEMS OF REESTABLISHING COMMERCIAL RECREATION BUSINESSES IN NEW YORK FOLLOWING HURRICANE AGNES,**  
New York State Coll. of Agriculture and Life Sciences, Ithaca.  
T. L. Brown.

Water Resources Bulletin, Vol. 11, No. 6, p 1261-1270, December 1975. 1 fig, 3 tab, 9 ref.

Descriptors: \*Flood damage, \*Marinas, \*Recreation, Evaluation, Management, \*New York, Economics.

Identifiers: \*Flood recovery, \*Hurricane Agnes, Campgrounds, Economic losses, Inventories, Commercial recreation firms.

Forty-two commercial campgrounds and thirty-four commercial marinas were studied to determine the amount and types of flood-related damages incurred from Hurricane Agnes, and to evaluate the institutional measures available to help management overcome these losses. Economic losses incurred by firms due to inability to operate, and declines in the number of recreationists, were over twice the magnitude of losses suffered via direct physical damages from flooding. The Federal Flood Insurance Program, as presently constituted, is of very little use to firms having structural investments in and over water. Most firms were complimentary of the Small Business Administration's loan programs. It appears that active programs of communication and promotion are needed following restoration of regions involved in natural disasters to reestablish the tourist industry of those regions. (Bell-Cornell)  
W76-08089

### 6G. Ecologic Impact Of Water Development

**LABORATORY AND FIELD TEMPERATURE PREFERENCE AND AVOIDANCE DATA OF FISH RELATED TO THE ESTABLISHMENT OF STANDARDS.**

Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W76-07494

**INITIAL SCIENTIFIC AND MINIECONOMIC REVIEW OF PARATHION.**

Midwest Research Inst., Kansas City, Mo.  
For primary bibliographic entry see Field 5G.  
W76-07612

**LAND DRAINAGE AS A FACTOR IN 'RED TIDE' DEVELOPMENT,**

Department of the Environment, Ottawa (Ontario). Shellfish Water Quality Div.  
For primary bibliographic entry see Field 5C.  
W76-07616

**PROCEEDINGS: LAKE TAHOE RESEARCH SEMINAR II, 27 SEPTEMBER 1974, SANDS VAGABOND CONVENTION CENTER, SOUTH LAKE TAHOE, CALIFORNIA,**

Lake Tahoe Area Research Coordination Board  
South Lake Tahoe, Calif.  
For primary bibliographic entry see Field 5G.  
W76-07793

**PROPOSED KAIPAROWITS PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT.**  
March 3, 1976. 3497 p, 289 fig, 321 illus, 770 ref.  
Final EIS, FES 76-12. (Six volume report).

Descriptors: \*Colorado River, \*Environmental effects, \*Utah, \*Electric power plants, \*Air pollution, Electric power production, Colorado River Compact, Coal mines, Water pollution sources, Mercury, Natural resources, Public lands, National parks, National recreation areas, National forests, National monuments, Aquifers, Water distribution(Applied), Land subsidence, Lakes, Tributaries, Drainage patterns(Geologic), Transmission lines.

Identifiers: \*Environmental impact statement, Mercury pollution, \*Kaiparowits project.

## RESOURCES DATA—Field 7

### Network Design—Group 7A

The Kaiparowits project located on Kaiparowits Plateau in southern Utah is planned as a 3,000 megawatt, coal-fired, electricity-generating station to provide power for areas of Arizona and southern California. Within a 100-mile radius of the project are National Parks, Forests, Recreation Areas and Monuments. The major environmental impact of the project would be degradation of the air quality of the surrounding area. Mercury from stack emissions deposited in local drainage basins tributary to Lake Powell would increase mercury bio-amplification in the ecosystem of the lake. Subsidence due to mining of coal for the project is expected to cause disruption of aquifers. The 50,000 acre-feet of Colorado River water used each year by the project would reduce Utah's remaining allotment by 10% and would also compound existing salinity problems in the river. The accumulated fly ash scrubber sludge residue would be a long-term pollution source for Lake Powell. Possible alternatives include transporting Kaiparowits coal to another site or using nuclear power. The 420 million tons of coal burned would replace 33 million barrels of crude oil. The present wild character of the area would be irreversibly altered. (Capehart-Florida)  
W76-07800

**ENVIRONMENTAL LAW: WHAT IS 'MAJOR' IN 'MAJOR FEDERAL ACTION', MINNESOTA PUBLIC INTEREST RESEARCH GROUP V. BUTZ, 498 F2D 1314 (8TH CIR. 1974).**  
For primary bibliographic entry see Field 6E.  
W76-07809

**ENVIRONMENTAL ASPECTS OF DEEP SEA MINING,**  
Center for Law and Social Policy, Washington, D.C.  
For primary bibliographic entry see Field 6E.  
W76-07815

**LEGAL CONSIDERATIONS FOR THE CONSTRUCTION AND OPERATION OF A DEEP-WATER OIL TERMINAL IN THE DELAWARE BAY,**  
Delaware Univ., Newark. Coll. of Marine Studies.  
For primary bibliographic entry see Field 6E.  
W76-07823

**SCIENTIFIC RESEARCH ARTICLES IN THE LAW OF THE SEA INFORMAL SINGLE NEGOTIATING TEXT,**  
Rhode Island Univ., Kingston. Law of the Sea Inst.  
For primary bibliographic entry see Field 6E.  
W76-07825

**MAJOR ISSUES OF THE LAW OF THE SEA,**  
New Hampshire Univ., Durham.  
For primary bibliographic entry see Field 6E.  
W76-07827

**MARINE POLLUTION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
For primary bibliographic entry see Field 6E.  
W76-07836

**CONCLUSION,**  
New Hampshire Univ., Durham. Law of the Sea Intern Program.  
For primary bibliographic entry see Field 6E.  
W76-07842

**STATUS REPORT ON LAW OF THE SEA CONFERENCE.**  
For primary bibliographic entry see Field 6E.  
W76-07861

**TWO-HUNDRED-MILE FISHING ZONE.**  
For primary bibliographic entry see Field 6E.  
W76-07863

**WATERSHED PROJECTS.**  
For primary bibliographic entry see Field 6E.  
W76-07866

**CORPS OF ENGINEERS OVERSIGHT HEARINGS - 1975,**  
For primary bibliographic entry see Field 6E.  
W76-07869

**AN EVALUATION OF THE POTENTIAL FOR ECOLOGICAL DAMAGE BY CHRONIC LOW-LEVEL ENVIRONMENTAL POLLUTION BY FLUORIDE,**  
California Inst. of Tech., Pasadena. Div. of Humanities and Social Sciences.  
For primary bibliographic entry see Field 5C.  
W76-08038

**A MULTI-OBJECTIVE FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT USING GOAL PROGRAMMING,**

McGill University, Montreal, Canada, Department of Civil Engineering and Applied Mechanics. D. Panagiakopoulos.

Journal of Environmental Systems, Vol. 5, No. 2 p 133-147, 1975. 4 fig, 6 ref.

Descriptors: \*Environment, \*Management, \*Wastes, \*Water quality, \*Optimization, Economics, Benefits, Costs, Analytical techniques, Decision making, Technology, Networks, Constraints, Biochemical oxygen demand, Air quality, Operations research, Mathematical models, Equations, Alternative planning, \*Regional analysis.

Identifiers: \*Multi-objective, \*Goal programming, Environmental quality, Policy planning, Cost minimization.

The scope of environmental management is to reach as much as possible a socially acceptable balance between economic benefits and resulting environmental quality; such a balance is defined in terms of politically established criteria and goals. Environmental management should also be concerned with integrating the often conflicting sub-goals of the economic, environmental, and technological components of the economic-environmental system into a multiple objective for guiding the development and evaluation of alternative policies. This paper presents a prescriptive framework for environmental management at the regional level which allows for a sufficiently realistic representation of the total system, deals systematically with multiple objectives through goal programming optimization techniques, and suggests an effective interaction between the decision maker and the analyst for devising compromises among conflicting objectives. This is designed as an improvement over the ad hoc trial-and-error analysis based on tradeoff relations. In essence, the procedure outlined here is directed toward establishing the economic-growth/environmental quality possibility frontier of a region. (Bell-Cornell)

## 7. RESOURCES DATA

### 7A. Network Design

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS,**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07570

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07571

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 3 - DES PLAINES RIVER BASIN.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07572

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07573

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS TRIBUTARIES.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07574

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07575

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07576

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA - VOLUME 3, DES PLAINES RIVER BASIN.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07577

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07578

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS ILLINOIS TRIBUTARIES.**

Illinois Environmental Protection Agency, Springfield, Div. of Water Pollution Control.  
For primary bibliographic entry see Field 7C.  
W76-07579

## Field 7—RESOURCES DATA

### Group 7A—Network Design

**DATA TRANSMISSION SYSTEM MONITORS RIVER POLLUTION.**  
For primary bibliographic entry see Field 5A.  
W76-08028

### 7B. Data Acquisition

**ENVIRONMENTAL MONITORING THROUGH THE USE OF EXPOSURE PANELS,**  
William F. Clapp Labs., Inc., Duxbury, Mass.  
For primary bibliographic entry see Field 5A.  
W76-07490

**AN APPROXIMATE ANALYSIS OF MELTING AND FREEZING OF A DRILL HOLE THROUGH AN ICE SHELF IN ANTARCTICA,**  
Syracuse Univ., N.Y. Dept. of Chemical Engineering and Material Sciences.  
For primary bibliographic entry see Field 2C.  
W76-07550

**PITTSBURGH RAINWATER ANALYSIS BY PIXE,**  
Pittsburgh Univ., Pa.  
For primary bibliographic entry see Field 5A.  
W76-07555

**EXTRACTION AND UTILIZATION OF SPACE ACQUIRED PHYSIOGRAPHIC DATA FOR WATER RESOURCES DEVELOPMENT,**  
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.  
For primary bibliographic entry see Field 4D.  
W76-07566

**ENVIRONMENTAL ASPECTS OF RUN-OFF AND SILTATION IN THE ANACOSTIA BASIN FROM HYPERALTITUDE PHOTOGRAPHS,**  
Maryland Univ., College Park.  
For primary bibliographic entry see Field 4D.  
W76-07568

**REFERENCE GUIDE TO METHODOLOGY FOR THE ANALYSIS OF ORGANIC COMPOUNDS.**  
Geological Survey, Bay St. Louis, Miss.  
For primary bibliographic entry see Field 5A.  
W76-07590

**MEASUREMENT AND PREDICTION OF SEDIMENT YIELDS IN WISCONSIN STREAMS,**  
Geological Survey, Madison, Wis.  
For primary bibliographic entry see Field 2J.  
W76-07600

**WRC AIDS UNIQUE WATER QUALITY MONITORING PROJECT.**  
Water Pollution Research Lab., Stevenage (England).  
For primary bibliographic entry see Field 5A.  
W76-07613

**COMPARISON OF LABORATORY AND FIELD DETERMINED SATURATED HYDRAULIC CONDUCTIVITY AND PREDICTION FROM SOIL PARTICLE SIZE,**  
University of the West Indies, St. Augustine (Trinidad). Dept. of Soil Science.  
For primary bibliographic entry see Field 2G.  
W76-07698

**SATELLITES HELPING TO SOLVE DOWN-TO-EARTH CIVIL ENGINEERING PROBLEMS.**  
Civil Engineering (ASCE), Vol. 45, No. 8, p 49-53. 3 fig. (August 1975).

**Descriptors:** \*Water pollution, \*Remote sensing, \*Satellites(Artificial), \*Photography, Measurement, \*Wetlands, Mapping, Air pollution, Land use, Ocean currents, Pollution, Effluents.  
**Identifiers:** \*Earth Resources Technology Satellite(ERTS-1).

The Earth Resources Technology Satellite (ERTS-1) has been orbiting the earth for over 3 years and has provided insight into many problems. There are limits: the satellite can photograph a particular site only once in 18 days, the resolution of the computer enhanced information is 1 acre, and it is not always possible to make distinctions which practitioners would like. Examples of many things which are possible are given. Water pollution can be detected in lakes and oceans. On Lake Superior pollution was determined to be present near a just-completed water intake structure which was badly located. A better location could have been found if photos had been available earlier. In Lake Champlain ERTS imagery detected pollution plumes and showed the extent of surface-water degradation due to effluence from a submerged diffuser pipe extending from a paper company. Such evidence would be used in prosecution of water pollution cases. It is hoped that in the future a satellite could determine not only the location, but also the nature and concentration of a pollutant. In a Wisconsin study researchers are trying to inexpensively classify lakes as to their degree of eutrophication. Many other studies have been aided by ERTS: detection of air pollution; study of ocean currents; keeping track of strip mining; locating faults and mineral deposits; and measuring snow cover. Coastal zone states have found satellite information to be of great use in regulating activities in sensitive wetland areas. Along the Georgia coast photos have offered spectacular definition of marshlands which would be otherwise impossible. In New Jersey satellites are being used to monitor unauthorized construction in wetlands. (Smith-North Carolina)  
W76-07737

**A BOTTOM SEDIMENT TRAP FOR RECENT SEDIMENTARY DEPOSITS,**  
National Swedish Environment Protection Board, Uppsala. Limnological Survey.  
For primary bibliographic entry see Field 2J.  
W76-07766

**ELECTROMAGNETIC REFLECTION FROM MULTI-LAYERED SNOW MODELS,**  
National Aeronautics and Space Administration, Moffett Field, Calif. Ames Research Center.  
For primary bibliographic entry see Field 2C.  
W76-07780

**APPLICATIONS OF REMOTE SENSING TO WATERSHED MANAGEMENT,**  
National Aeronautics and Space Administration, Greenbelt, Md. Goddard Space Flight Center.  
For primary bibliographic entry see Field 4A.  
W76-07791

**THE 'RHEODROM', A NEW FLOWING WATER RESEARCH APPARATUS, (IN GERMAN),**  
L. Ibscher, and A. Keller.  
Schweiz z Hydrol 37(1); p 187-192, 1975.

**Descriptors:** \*Invertebrates, \*Testing, Instrumentation, \*Measurement.  
**Identifiers:** Rheodrom.

The EAWAG's (Eidgenossischen Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz) Rheodrom is a multi-purpose installation, built for hydraulic and ecological experiments, tests with invertebrates in running waters in particular. It is a cyclical system. Approximately 9 m<sup>3</sup> water are recirculated through rectangular plexiglass troughs, 6 m in length, 30 cm deep and

15 cm wide. Slope, temperature (4-28°C) and ground substrate are variable. Light-dark alternations can be produced externally. There is O<sub>2</sub> saturation of the water at all times. An increase in heavy metals owing to mechanical attrition cannot be proven.--Copyright 1975, Biological Abstracts, Inc.  
W76-07945

**APPLICATIONS OF SHANNON'S INDEX TO THE STUDY OF INTERTIDAL VEGETATION, (IN FRENCH),**  
Instituto de Investigaciones Pesqueras, Vigo (Spain). Laboratorio de Investigaciones Pesqueras.  
For primary bibliographic entry see Field 2L.  
W76-07949

**A RECIRCULATION SYSTEM FOR EXPERIMENTAL AQUARIUM,**  
M. B. New, J. P. Scholl, J. C. McCarthy, and J. P. Bennett.  
Aquaculture. 3(1), p 95-103, 1974.

**Descriptors:** \*Aquaria, \*Design, Model studies, \*Recirculated water.  
**Identifiers:** Experimentation.

A basis design for a compact, self-contained unit for experimental aquaria is described. Thirty-six 10-gallon tanks are linked in a temperature-controlled water recirculation system. Water turnover rates up to 85%/h are maintained through an upward displacement biological filter, with temperature control of plus or minus 0.1°C in the system and plus or minus 0.2°C between individual tanks. The complete unit occupies 36 ft<sup>2</sup> (3.3 m<sup>2</sup>) of floor space. All tanks are easily inspected and maintenance is minimal.--Copyright 1975, Biological Abstracts, Inc.  
W76-07972

**PRELIMINARY NOTE ON THE OBSERVATION OF TERRIGENOUS DRIFTS INTO THE SEA, OBTAINED BY MEANS OF TELEVISED PICTURES TRANSMITTED BY ARTIFICIAL SATELLITES, (IN FRENCH),**  
Centre d'Oceanographie, Marseille (France). Station Marine d'Endoume.  
For primary bibliographic entry see Field 5B.  
W76-07992

**ULTRASONICS IN THE SEWAGE INDUSTRY,**  
Municipality of Metropolitan Seattle, Wash.  
For primary bibliographic entry see Field 5D.  
W76-08018

**ON THE USE OF LITTER BAG METHOD FOR STUDYING DEGRADATION IN AQUATIC HABITATS,**  
Queen's Univ. Belfast (Northern Ireland). Dept. of Botany.  
D. Park.  
Int Biodegrad Bull. 10(2), p 45-48, 1974.

**Descriptors:** \*Sampling, Methodology, \*Microbial degradation, Aquatic habitats, Rivers.  
**Identifiers:** \*Litter bag method.

The litter bag method is used to follow weight changes in filter paper immersed in a small river with a variable rate of flow. A characteristic increase in weight occurs before there is any overall weight loss. Several possible processes are considered that might contribute to accumulation of material. Eventual weight loss and breakdown of cellulose may be the result of different processes, or combinations of them, one only of which is microbial decomposition. It is argued that weight loss studies by the litter bag method do not permit a full analysis of the range of processes occurring during breakdown.--Copyright 1975, Biological Abstracts, Inc.  
W76-08041

## 7C. Evaluation, Processing and Publication

**ANALYSIS OF STRUCTURAL AND NON-STRUCTURAL FLOOD CONTROL MEASURES USING COMPUTER PROGRAM HEC-5C,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07564

**WATER MOVEMENT THROUGH SATURATED-UNSATURATED POROUS MEDIA: A FINITE-ELEMENT GALERKIN MODEL,**  
Oak Ridge National Lab., Tenn.  
For primary bibliographic entry see Field 2F.  
W76-07569

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS,**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
96 p, 3 fig. (1975)

Descriptors: \*Water quality, \*Illinois, \*Data collections, \*Ohio River, Sampling, Monitoring, Networks, Rivers, Streams, Lakes, River basins, Pollutants, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water), Water temperature.  
Identifiers: \*Wabash River basin(III).

The Illinois Environmental Protection Agency carries out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1974 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume I presented data for all sampling points located in areas which drain either into the Ohio or Wabash Rivers. A key to headings utilized in the report was provided, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 88 sampling points in the Ohio-Wabash drainage area included water temperature, dissolved oxygen, pH, biochemical and chemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)  
W76-07570

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS.**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
174 p, 3 fig. (1975).

Descriptors: \*Water quality, \*Illinois, \*Data collections, Sampling, Monitoring, Networks, Rivers, Streams, Lakes, River basins, Pollutants, Water pollution, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water), Water temperature.  
Identifiers: \*Illinois River basin(III), \*Fox River basin(III), \*Sangamon River basin(III), \*Kankakee River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the na-

ture and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume II presented data for all sampling points located in areas which drain into one of the following rivers: Illinois (excluding the Des Plaines River), Fox, Sangamon, and Kankakee. A key to headings utilized in the report was provided, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 156 sampling points in the Illinois, Fox, Sangamon, and Kankakee drainage areas included water temperature, dissolved oxygen, pH, biochemical and chemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)  
W76-07571

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 3 - DES PLAINES RIVER BASIN.**

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
154 p, 3 fig. (1975)

Descriptors: \*Water quality, \*Illinois, \*Data collections, Sampling, Monitoring, Networks, River basins, Rivers, Streams, Lakes, Pollutants, Water pollution, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water), Water temperature.  
Identifiers: \*Des Plaines River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report presented summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume III contained data for all sampling points located in areas which drain into the Des Plaines River. A key to headings utilized was included, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 136 sampling points in the Des Plaines drainage area included water temperature, dissolved oxygen, pH, biochemical and chemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)  
W76-07572

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS.**

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
180 p, 3 fig. (1975)

Descriptors: \*Water quality, \*Illinois, \*Mississippi River basin, \*Data collections, Sampling, Monitoring, Networks, Rivers, Streams, Lakes, River basins, Pollutants, Water pollution, Coliforms, Nutrients, Heavy metals, Suspended

solids, Dissolved oxygen, Color, Turbidity, Hardness(Water), Water temperature, Hydrogen ion concentration, Biochemical oxygen demand.  
Identifiers: \*Big Muddy River Basin(III), \*Kaskaskia River basin(III), \*Rock River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report presented summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume IV contained data for all sampling points located in areas which drain into one of the following: Mississippi River, South; Mississippi River, South Central; Mississippi River, Central; Mississippi River, North Central; Mississippi River, North; Big Muddy River, Kaskaskia River, or Rock River. A key to headings utilized was presented, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. The water quality parameters given for the 164 sampling points in the Mississippi, Big Muddy, Kaskaskia, and Rock River drainage areas included water temperature, dissolved oxygen, pH, biochemical and chemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)  
W76-07573

**WATER QUALITY NETWORK, 1974 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS TRIBUTARIES.**

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
49 p, 3 fig. (1975)

Descriptors: \*Water quality, \*Illinois, \*Lake Michigan, \*Data collections, Sampling, Monitoring, Networks, Lakes, Tributaries, Streams, Rivers, Pollutants, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water), Water temperature, Water pollution.

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report contained summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume V presented data for all sampling points located on Lake Michigan or its Illinois tributaries. A key to headings utilized was included, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 40 sampling points on Lake Michigan and its tributaries included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)  
W76-07574

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 1 - OHIO AND WABASH RIVER BASINS.**

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.

## Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

100 p, 3 fig. (1974)

Descriptors: \*Water quality, \*Illinois, \*Data collections, \*Ohio River, Sampling, Monitoring, Networks, Rivers, River basins, Streams, Lakes, Pollutants, Water pollution, Pollutant identification, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Hydrogen ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water), Water temperature. Identifiers: \*Wabash River basin(III).

The Illinois Environmental Protection Agency carries out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1973 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume I contained data for all sampling points located in areas which drain either into the Ohio or Wabash Rivers. A key to headings utilized in the report was presented, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 88 sampling points in the Ohio-Wabash drainage area included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS) W76-07575

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 2 - ILLINOIS, FOX, SANGAMON, AND KANKAKEE BASINS.**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
272 p, 3 fig.

Descriptors: \*Water quality, \*Illinois, \*Data collections, Sampling, Monitoring, Networks, Rivers, River basins, Streams, Lakes, Pollutants, Water pollution, Pollutant identification, Coliforms, Nutrients, Heavy metals, Suspended solids, Hydrogen ion concentration, Biochemical oxygen demand, Dissolved oxygen, Color, Turbidity, Hardness(Water), Water temperature. Identifiers: \*Fox River basin(III), \*Sangamon River basin(III), \*Kankakee River basin(III), \*Illinois River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1973 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume II contained data for all sampling points located in areas which drain into one of the following rivers: Illinois (excluding the Des Plaines River), Fox, Sangamon, or Kankakee. A key to headings utilized in the report was presented, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 157 sampling points in the drainage areas of the Illinois, Fox, Sangamon, and Kankakee rivers included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS) W76-07576

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA - VOLUME 3, DES PLAINES RIVER BASIN.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
150 p, 3 fig.

Descriptors: \*Water quality, \*Illinois, \*Data collections, Sampling, Monitoring, \*Networks, Rivers, River basins, Streams, Lakes, Pollutants, Pollutant identification, Water pollution, Coliforms, Nutrients, Heavy metals, Suspended solids, Hydrogen ion concentration, Biochemical oxygen demand, Dissolved oxygen, Color, Turbidity, Hardness(Water), Water temperature. Identifiers: \*Des Plaines River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1973 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume III contained data for all sampling points located in areas which drain into the Des Plaines River. A key to headings utilized was provided, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 136 sampling points in the Des Plaines River drainage area included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS)

**WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 4 - MISSISSIPPI RIVER (SOUTH, SOUTH CENTRAL, CENTRAL, NORTH CENTRAL, NORTH), BIG MUDDY RIVER, KASKASKIA RIVER, AND ROCK RIVER BASINS.**  
Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
179 p, 3 fig.

Descriptors: \*Water quality, \*Illinois, \*Mississippi River, \*Data collections, Sampling, Monitoring, Networks, Rivers, River basins, Streams, Lakes, Water pollution, Pollutants, Pollutant identification, Coliforms, Nutrients, Heavy metals, Suspended solids, Dissolved oxygen, Color, Turbidity, Hydrogen ion concentration, Biochemical oxygen demand, Hardness(Water), Water temperature. Identifiers: \*Big Muddy River basin(III), \*Kaskaskia River basin(III), \*Rock River basin(III).

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1973 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume IV contained data for all sampling points located in areas which drain into one of the following: Mississippi River, South; Mississippi River, South Central; Mississippi River, Central; Mississippi River, North Central; Mississippi River, North; Big Muddy River, Kaskaskia River, or Rock River. A key to headings utilized was presented, along with the meaning of each. Where the heading is a measurable parameter, the meaning included

the unit of expression for this parameter. Water quality parameters given for the 164 sampling points in the Mississippi, Big Muddy, Kaskaskia, and Rock River drainage basins included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS) W76-07578

#### WATER QUALITY NETWORK, 1973 SUMMARY OF DATA, VOLUME 5 - LAKE MICHIGAN AND ITS ILLINOIS TRIBUTARIES.

Illinois Environmental Protection Agency, Springfield. Div. of Water Pollution Control.  
82 p, 3 fig.

Descriptors: \*Water quality, \*Illinois, \*Data collections, \*Lake Michigan, \*Tributaries, Sampling, Monitoring, Networks, Lakes, Rivers, Streams, Pollutants, Water pollution, Pollutant identification, Coliforms, Nutrients, Heavy metals, Dissolved oxygen, Suspended solids, Hydrogen Ion concentration, Biochemical oxygen demand, Color, Turbidity, Hardness(Water). Water temperature.

The Illinois Environmental Protection Agency has carried out a program of regular sampling of the streams and lakes of Illinois to determine the nature and extent of water pollution in the state, and to provide the basic water quality data necessary to carry out the agency's mission of reducing pollution of Illinois waters. This five-volume report included 1973 summary statistics for the parameters of water quality measured most frequently by the agency at 614 sampling stations which make up the Illinois Water Quality Network. Volume V contained data for all sampling points located on Lake Michigan or its Illinois tributaries. A key to headings utilized was presented, along with the meaning of each. Where the heading is a measurable parameter, the meaning included the unit of expression for this parameter. Water quality parameters given for the 71 sampling stations along Lake Michigan and its tributaries included water temperature, dissolved oxygen, pH, biochemical oxygen demand, fecal coliforms, nutrient loadings, suspended solids, turbidity, hardness, color, total plankton, oil, phenol, methylene blue active substances, heavy metals, and other pollutants. (Robinson-ISWS) W76-07579

#### DETERMINATION OF THE FREQUENCY OF PRECIPITATION IN EXCESS OF DESIGN CRITERIA AT MORE THAN A SINGLE LOCATION DURING A HYDROLOGIC SEASON, Missouri Univ., Columbia. Dept. of Atmospheric Science.

For primary bibliographic entry see Field 2B.  
W76-07581

#### AVAILABILITY OF GROUND WATER IN THE PEMIGEWASSET AND WINNIPESAUKEE RIVER BASINS, CENTRAL NEW HAMPSHIRE, Geological Survey, Concord, N. H.

J. E. Cotton.

Water-Resources Investigations 47-75 (open-file report), 1975. 1 sheet, 3 ref.

Descriptors: \*Groundwater resources, \*Aquifer characteristics, \*Available water, \*Water quality, \*New Hampshire, Hydrologic data, Hydrogeology, Maps. Identifiers: \*Upper Connecticut River basin(N H).

This map provides a preliminary assessment of the availability of groundwater in the Pemigewasset and Winnipesaukee River basins, central New Hampshire. It is a generalization of several hydrogeologic factors and provides a guideline for groundwater exploration which is useful in water-

## RESOURCES DATA—Field 7

### Evaluation, Processing and Publication—Group 7C

and land-use planning. The most productive aquifers in the basins are deposits of stratified sand or sand and gravel of Pleistocene age. Extensive aquifers of this type occur in the Pemigewasset River valley. Aquifers of this type occur in the valleys of larger tributaries to the Pemigewasset River and in the larger valleys in the Winnipesaukee River basin. Groundwater is generally of good chemical quality, but iron and manganese in concentrations greater than the recommended limits for drinking water suggested by the U.S. Public Health Service are not uncommon. (Woodard-USGS)  
W76-07589

**RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 2. KING AND SNOHOMISH COUNTIES,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2H.  
W76-07591

**RECONNAISSANCE DATA ON LAKES IN WASHINGTON--VOLUME 1. CLALLAM, ISLAND, JEFFERSON, SAN JUAN, SKAGIT, AND WHATCOM COUNTIES,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2H.  
W76-07592

**DIGITAL MODEL OF THE GRAVEL AQUIFER, WALLA WALLA RIVER BASIN, WASHINGTON AND OREGON,**  
Geological Survey, Tacoma, Wash.  
For primary bibliographic entry see Field 2F.  
W76-07593

**SPRINGS OF PENNSYLVANIA,**  
Geological Survey, Harrisburg, Pa.  
For primary bibliographic entry see Field 2F.  
W76-07604

**LAKE ERIE, OHIO, PENNSYLVANIA, NEW YORK INTAKE WATER QUALITY SUMMARY 1972,**  
Environmental Protection Agency, Fairview Park, Ohio.  
For primary bibliographic entry see Field 5A.  
W76-07610

**GLACIER SURVEYS IN ALBERTA - 1971,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
For primary bibliographic entry see Field 2C.  
W76-07680

**FLOOD PLAIN INFORMATION: CLINTON RIVER AND PAINT CREEK, OAKLAND COUNTY, MICHIGAN.**  
United States Lake Survey, Detroit, Mich.  
For primary bibliographic entry see Field 4A.  
W76-07720

**FLOOD PLAIN INFORMATION: NORTH YUBA AND DOWDIE RIVERS, DOWDIEVILLE, CALIFORNIA.**  
Army Engineer District, Sacramento, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07721

**FLOOD PLAIN INFORMATION: ROCK RIVER-POPLAR CREEK, LUVERNE AND VICINITY, MINNESOTA.**  
Army Engineer District, Omaha, Nebr.  
For primary bibliographic entry see Field 4A.  
W76-07722

**FLOOD PLAIN INFORMATION: KETTLE CREEK, WAYCROSS AND WARE COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07723

**FLOOD PLAIN INFORMATION: HURRICANE CREEK, ALMA AND BACON COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07724

**FLOOD PLAIN INFORMATION: LITTLE CRAB ORCHARD CREEK AND PILES FORK CREEK, CARBONDALE, ILLINOIS.**  
Army Engineer District, St. Louis, Mo.  
For primary bibliographic entry see Field 4A.  
W76-07725

**FLOOD INSURANCE STUDY: PLEASANTON, ALAMEDA COUNTY, CALIFORNIA, (PRELIMINARY REPORT),**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07726

**FLOOD PLAIN INFORMATION: MINNESOTA RIVER AND TRIBUTARIES, MANKATO, NORTH MANKATO, LE HILLIER.**  
Army Engineer District, St. Paul, Minn.  
For primary bibliographic entry see Field 4A.  
W76-07727

**FLOOD PLAIN INFORMATION: GRAND RIVER, GRAND RAPIDS, MICHIGAN AND VICINITY.**  
United States Lake Survey, Detroit, Mich.  
For primary bibliographic entry see Field 4A.  
W76-07728

**FLOOD PLAIN INFORMATION: MISSISSIPPI RIVER-SAUK RIVER-WATAB RIVER, VICINITY OF ST. CLOUD, MINNESOTA.**  
Army Engineer District, St. Paul, Minn.  
For primary bibliographic entry see Field 4A.  
W76-07729

**FLOOD PLAIN INFORMATION: YALOBUSHWA RIVER AND TRIBUTARIES, GRENADA, MISSISSIPPI.**  
Army Engineer District, Vicksburg, Miss.  
For primary bibliographic entry see Field 4A.  
W76-07730

**FLOOD PLAIN INFORMATION: CEDAR CREEK, ATHENS AND CLARKE COUNTY, GEORGIA.**  
Army Engineer District, Savannah, Ga.  
For primary bibliographic entry see Field 4A.  
W76-07731

**FLOOD PLAIN INFORMATION: FRESNO RIVER AND COTTONWOOD, LITTLE DRY, AND ROOT CREEKS, MADERA, CALIFORNIA.**  
Army Engineer District, San Francisco, Calif.  
For primary bibliographic entry see Field 4A.  
W76-07732

**FLOOD PLAIN INFORMATION: MILL SLOUGH, OSCEOLA AND ORANGE COUNTIES, FLORIDA.**  
Army Engineer District, Jacksonville, Fla.  
For primary bibliographic entry see Field 4A.  
W76-07733

**FLOOD PLAIN INFORMATION: BIG THOMPSON RIVER, LOVELAND, COLORADO.**  
Army Engineer District, Omaha, Nebr.  
For primary bibliographic entry see Field 4A.  
W76-07734

**FLOOD PLAIN INFORMATION: NORTH FORK REPUBLICAN RIVER, WRAY, COLORADO.**  
Army Engineer District, Kansas City, Mo.  
For primary bibliographic entry see Field 4A.  
W76-07739

**PREDICTING SNOWMELT RUNOFF USING A DETERMINISTIC WATERSHED MODEL WITH STOCHASTIC PRECIPITATION INPUTS,**  
Arizona Univ. Tucson. School of Renewable Natural Resources.  
For primary bibliographic entry see Field 2A.  
W76-07764

**FLOOD ESTIMATION FROM SHORT RECORDS,**  
Queensland Irrigation and Water Supply Commission, Brisbane (Australia).  
For primary bibliographic entry see Field 4A.  
W76-07771

**AN INVESTIGATION OF THE OCCURRENCE OF OCEANIC TURBULENCE WITH RESPECT TO FINESTRUCTURE,**  
Department of the Environment, Victoria (British Columbia). Inst. of Ocean Sciences.  
For primary bibliographic entry see Field 2L.  
W76-07773

**SEASONAL VARIATIONS AND STATIONARITY,**  
Iceland Univ., Reykjavik. Science Inst.  
For primary bibliographic entry see Field 2A.  
W76-07784

**WATER DATA COLLECTION AND USE,**  
Department of the Environment, London (England). Water Data Unit.  
D. W. C. Rodda.  
Water Pollution Control, Vol. 75, No. 1, p 115-123, 1976. 1 fig, 2 tab, 7 ref, 2 append.

**Descriptors:** \*Water districts, \*Data collections, Data processing, Hydrologic data, Communication, \*Information exchange, \*Information retrieval, \*Pollutant identification, Water quality, International waters, Water transfer, \*Monitoring.

The paper concerned the difference between data and information. Data were described as the quantitative evidence identifying the state or extent of something and from which inferences may be drawn. Data can be a whole series of meaningful patterns which are generated indefinitely and stored in a computer. Information is the answer to why the data appear as they do. Data are collected to gain information about the environment, what it comprises, what effect people have on it. Water data were grouped according to several functions of water authorities, and it was stated that the Water Data Unit is the main route in England along which information about all aspects of water and the water industry will be given to water authorities. A national network is being established by setting up 200 sampling stations and inter-laboratory compatibility in the analysis of water samples. Data retrieval options were discussed for planning, monitoring and control of pollution, and operations. Future needs were discussed, both for computers and human intervention for data validation. Water data collection involved the water quality for future generations and would be the basis from which authorities could set aside the ills of past generations. (Roberts - ISWS)  
W76-07785

## Field 7—RESOURCES DATA

### Group 7C—Evaluation, Processing and Publication

**SYNTHETIC MONTHLY RUN-OFF RECORDS FOR UNGAUGED BRITISH CATCHMENTS,**  
Northumbrian River Authority, Gosforth  
(England).  
For primary bibliographic entry see Field 4A.  
W76-08010

**QUALITY OF SURFACE WATERS OF THE UNITED STATES, 1970: PARTS 9 AND 10. COLORADO RIVER BASIN AND THE GREAT BASIN.**  
Geological Survey, Reston, Va.  
Available from Supt. of Documents, GPO, Wash., DC, 20402, price \$3.40. Water-Supply Paper 2158, 1976. 371 p, 1 fig, 41 ref.

Descriptors: \*Water quality, \*Surface waters, \*Colorado River basin, \*Great basin, Basic data collections, Arizona, California, Idaho, New Mexico, Utah, Wyoming. Water analysis, Chemical analysis, Sediment transport, Partical size, Water temperature, Streamflow, Flow rates.

During the water year ending September 30, 1970, the Geological Survey maintained 154 stations on 88 streams for the study of chemical and physical characteristics of surface water in Colorado and Great River basins. Samples were collected daily and monthly at 142 of these locations for chemical-quality studies. Samples also were collected less frequently at many other points. Water temperatures were measured continuously at 8 and daily at 45 stations. Quantities of suspended sediment are reported for 34 stations. Sediment samples were collected one or more times daily at most stations, depending on the rate of flow and changes in stage of the stream. Partical-size distributions of sediments were determined at 19 stations. The stream discharges reported in the tables of single analyses are either daily mean discharges or discharges obtained at the time samples were collected and computed from a stage-discharge relation or from a discharge measurement. For a composite water-quality sample, the discharge is usually the average of daily mean discharges for the composite period. (Woodard-USGS)  
W76-08045

**WATER RESOURCES DATA FOR COLORADO, 1974: PART 2. WATER QUALITY RECORDS,**  
Geological Survey, Denver, Colo.  
Basic-Data Report, 1975. 190 p, 1 fig, 5 tab, 32 ref.

Descriptors: \*Water quality, \*Surface waters, \*Colorado, \*Water analysis, \*Chemical analysis, Physical properties, Sediment transport, Water temperature, Basic data collections, Streams, Discharge(Water).

Water quality information for Colorado surface waters collected during the 1974 water year is presented for chemical quality, fluvial sediment, and water temperatures. The chemical quality includes concentrations of individual dissolved constituents and certain properties or characteristics such as hardness, sodium-adsorption-ratio, specific conductance, and pH. Fluvial sediment information is given for suspended-sediment discharges and concentrations and for particle size distribution of suspended sediment and bed material. Water temperature data represent once-daily observations except for stations where a continuous temperature recorder furnishes information from which daily minimums and maximums are obtained. The data include a description of the sampling station and tabulations of the samples analyzed. The description of the sampling station gives the location, drainage area, periods of record for the various water-quality data, extremes of the pertinent data, and general remarks. (Woodard-USGS)  
W76-08047

**ANNUAL PEAK DISCHARGES FROM SMALL DRAINAGE AREAS IN MONTANA THROUGH SEPTEMBER 1975,**  
Geological Survey, Helena, Mont.  
For primary bibliographic entry see Field 2E.  
W76-08049

**RECORDS OF WELLS, SPRINGS, AND STREAMS IN THE POTOMAC RIVER BASIN, WEST VIRGINIA,**  
Geological Survey, Morgantown, W. Va.  
For primary bibliographic entry see Field 4B.  
W76-08055

**SURFACE-WATER RESOURCES OF THE TAN-GIPAHOA, TCHEFUNCTA, AND NATALBANY RIVER BASINS, SOUTHEASTERN LOUISIANA,**  
Geological Survey, Baton Rouge, La.  
For primary bibliographic entry see Field 4A.  
W76-08056

**WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1975,**  
Geological Survey, Lawrence, Kans.  
Water-Data Report KS-75-1, February 1976. 405 p, 4 fig, 3 tab, 32 ref.

Descriptors: \*Basic data collections, \*Surface waters, \*Groundwater, \*Water quality, \*Kansas, Streamflow, Gaging stations, Flow rates, Sediment transport, Observation wells, Water levels, Lakes, Reservoirs, Water analysis, Chemical analysis.

Water resources data for the 1975 water year for Kansas consists of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge records for 143 gaging stations; stage and contents for 20 lakes and reservoirs; water quality for 69 gaging stations; and water levels for 11 observation wells. Also included are data for 125 crest-stage partial-record stations and 23 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U. S. Geological Survey and cooperating State and Federal agencies in Kansas. (Woodard-USGS)  
W76-08057

**GEOHYDROLOGIC SIGNIFICANCE OF LITHOFACIES OF THE CARRIZO SAND OF ARKANSAS, LOUISIANA, AND TEXAS AND THE MERIDIAN SAND OF MISSISSIPPI,**  
Geological Survey, Baton Rouge, La.  
For primary bibliographic entry see Field 2F.  
W76-08061

**MIX2: A COMPUTER PROGRAM FOR MODELING CHEMICAL REACTIONS IN NATURAL WATERS,**  
Geological Survey, Reston, Va.

I. N. Plummer, D. L. Parkhurst, and D. R. Kosior. Available from the National Technical Information Service, Springfield, Va 22161, as PB-251-668/A's \$4.50 printed copy, \$2.25 microfiche. Water-Resources Investigations WRI 75-61, December 1975. 68 p, 4 tab, 14 ref.

Descriptors: \*Computer models, \*Geochemistry, \*Chemical reactions, \*Inorganic compounds, \*Water chemistry, Analytical techniques, \*Computer programs, Mixing, Volumetric analysis, Solubility, Aqueous solutions, Chemical precipitation, Solvation, Saturation, Equilibrium, Hydrogen ion concentration, Input-output analysis, Model studies.  
Identifiers: \*FORTRAN IV, MIX2.

MIX2 is a FORTRAN IV computer program that utilizes an aqueous model and the constraints of mass balance and electrical balance to compute

the pH and equilibrium distribution of inorganic species as a result of net reaction progress in the closed system: CaO-MgO-Na2O-K2O-CO2-H2SO4-HCl-H2O. The program considers three general classes of problems involving net reaction progress: (1) mixing of two solutions in fixed volume, (2) titration of one solution into another (variable volume), and (3) the addition or subtraction of a net stoichiometric reaction to or from an aqueous solution. In addition, MIX2 will follow one phase boundary through any of the above classes of problems. This report presents the theory and method of calculation used by MIX2, describes the input to the program, presents results of two test cases, and provides a program listing. (Woodard-USGS)  
W76-08062

**APPLICATION OF LINEAR PROGRAMMING OPTIMIZATION TO A NORTHERN ONTARIO HYDRO POWER SYSTEM,**  
Environment Canada, Ottawa, Ontario, Water Planning and Management Branch.  
For primary bibliographic entry see Field 4A.  
W76-08074

**SIZING FLOOD CONTROL RESERVOIR SYSTEMS BY SYSTEMS ANALYSIS,**  
Hydrologic Engineering Center, Davis, Calif.  
For primary bibliographic entry see Field 4A.  
W76-08085

**METHODOLOGY FOR THE SELECTION AND TIMING OF WATER RESOURCES PROJECTS TO PROMOTE NATIONAL ECONOMIC DEVELOPMENT,**  
Colorado State Univ., Fort Collins. Dept. of Civil Engineering.  
For primary bibliographic entry see Field 6B.  
W76-08091

## 8. ENGINEERING WORKS

### 8A. Structures

**SPILLWAY GATE MODIFICATION, BONNEVILLE DAM, COLUMBIA RIVER, OREGON AND WASHINGTON, HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Div. North Pacific, Bonneville, Oreg. Div. Hydraulic Lab.  
For primary bibliographic entry see Field 8B.  
W76-07792

**PROPOSED KAIPAROWITS PROJECT, FINAL ENVIRONMENTAL IMPACT STATEMENT.**  
For primary bibliographic entry see Field 6G.  
W76-07800

**CORPS OF ENGINEERS OVERSIGHT HEARINGS - 1975,**  
For primary bibliographic entry see Field 6E.  
W76-07869

**LAYING 5,000 FT. OF METAL PIPE IN 24 DAYS.**  
Excavating Contractor, Vol. 67, No. 4, p 28, June, 1973. 2 fig.

Descriptors: \*Storm drains, \*Drainage systems, \*Installation, Excavation, Backfill, Pipes, Construction equipment, Trenches, Manholes, Construction materials.  
Identifiers: Rochester(Mich), Pipelaying.

The installation of over 5000 feet of storm drain as part of a drainage system for a 150 home subdivision in Rochester, Michigan, required more than 50 manholes and a considerable amount of ex-

## ENGINEERING WORKS—Field 8

### Hydraulics—Group 8B

cavating and backfilling work. The entire project was completed in just 24 working days averaging 200 feet per day which included excavating, pipelaying, and backfilling. Trenches were formed to a depth of eight feet and a width of six feet to provide ample room for the corrugated metal pipe specified for the installation. The pipe ranged from 12 to 42 inches in diameter. The Ray W. Malow Company of Utica, Michigan, used a Poclain RC-200 excavator in the project. (Sandoski-FIRL)  
W76-07995

**PAPER DRAINS DEWATER EMBANKMENT.**  
Engineering News Record, Vol. 190, No. 23, p 17, June 7, 1973.

Descriptors: \*Drains, \*Embankments, Highways, Soils, Arsenic compounds, Drainage systems, Construction costs, Pipes.

Identifiers: Paper drains, Melamine resin.

A Canadian contractor is installing paper drains instead of sand drains for the first time on a North American construction job. A Japanese-built rig that works much like a sewing machine is placing the paper drains, at a rate of 1.5 per minute, to de-water and consolidate earth below a highway embankment near Trois Rivieres, Quebec. The \$350,000 contract calls for installing 8000 vertical drains to consolidate a layer of mixed silt, clay, and sand for a two-mile road section. The 4 x 1/8-inch paper strips are impregnated with arsenic salt to slow bacterial action and with melamine resin to increase their wet strength. Once in place, water is forced upward through ten small tubular channels between the outside glued faces of the drains by the weight of the embankment. Tests on other job sites in Europe and Japan show that the paper drains produce faster consolidation at a lower cost than conventional sand drains. (Sandoski-FIRL)  
W76-07996

**THE MAINTENANCE AND MANAGEMENT OF SEWAGE PIPE SYSTEMS (GESUIKANRO NO IJI KANRI),**  
Osaka Municipal Government Bureau of Sewage Works (Japan).

T. Mishiro, and M. Azuma.

Gesuido Kyokai-shi, (Journal of Japan Sewage Works Association), Vol. 10, No. 108, p 41-56, May, 1973. 6 fig, 13 tab.

Descriptors: \*Sewerage, \*Maintenance, \*Management, Pipelines, Monitoring, Dredging, Sludge, Mud, Pipes, Storm drains, Water quality control, Data collection, Corrosion control, Inspection.

Identifiers: Osaka(Japan).

The 826 km of pipelines utilized by 700,000 people in the four districts of the Osaka Municipal Government, Japan, are serviced by a maintenance force of 109. Continuous monitoring of conditions and data collection are two of the aims, yet problems are mounting with the constant increase of sewage and the deterioration of the lines. In 1971, high pressure cleaning cars dredged 29,719 meters of pipes which is less than 10 percent of the total length. Accordingly, the dredge work maintenance is concentrated on the most problematic areas. Sludge and mud collected manually or by machine are treated by a grid collector and used for landfill. Improvement plans include replacement of the old pipeline system, the use of anti-corrosive pipes for factory areas, periodic dredge work and leveling of pipe systems where possible, installation of bypass pipes for congested areas, regular inspection and dredge work of storm runoff drainage pipes, and installation of new branch pipelines. (Seigle-FIRL)  
W76-08005

**ANOTHER WAY TO PUT A PIPE IN A RIVERBED,**  
World Construction, Vol. 26, No. 5, p 50, May, 1973. 3 fig.

Descriptors: \*Pipes, \*Construction, Weirs, Outlets, Mississippi River, Cooling water, Rivers, Construction materials, Engineering, Concrete pipes.

Identifiers: Power generating station, New Madrid(Mo).

Cooling water piping for the first unit of the new power generation station on the bend of the Mississippi River at New Madrid, Missouri, posed several unique engineering and construction problems. Therefore, heavy core, double prestressed concrete subaqueous pressure pipe was specified - pipe designed to take a three-edge crushing load of 855 kg/linear centimeter. With unusual river conditions the pump structure was treated as a separate unit and installed on land at the shore end of the subaqueous pipe. The intake structure was then fabricated on land and sunk into position after the pipe was laid. Standard 3.04-meter prestressed concrete pressure pipe was used from the pump structure to and from the main generating complex to the sealing weir and outfall. A 2.13-meter diameter branch line also was installed for future use. (Sandoski-FIRL)  
W76-08011

**PREFAB CASTING SYSTEM PACES SEWER JOB THROUGH WET SITE,**  
McGraw-Hill World News, Vienna (Austria).

F. H. Baer.

Construction Methods and Equipment, Vol. 55, No. 7, p 114-115, July, 1973. 5 fig.

Descriptors: \*Pipes, \*Construction, Construction equipment, Treatment facilities, Sewerage, Equipment, Concrete, Waste water treatment.

Identifiers: Vienna(Austria), \*Prefabricated pipes.

A method of prefabricating and setting more than 650 sections of pipe required a highly mobile casting system able to advance continuously with the job as well as an intricate transport system to lift, tilt, and carry the sections to the trench for placement. Most of the pipe sections weighing 61 tons are almost 20 feet long and over 16 feet in diameter. They are cast vertically in pairs with cylindrical rebar cages encased by semi-circular steel forms. At their base, forms are socketed into portable rings of concrete and steel laid on solid ground between parallel lines of sheet piles. Two prefab pipe sections requiring 27.5 yards of concrete are poured each day by crane and bucket. A specially designed strongback-type rig handled by two 50-ton Portoli gantry cranes lifts, tilts, and then holds a pipe section horizontally while the cranes carry it to the trench for setting. The cranes work in tandem, traveling an average of 560 feet over rails laid outside the lines of sheet piles. Each pipe section is landed on two 3.25- by 10-foot semi-circular concrete blocks prefabricated onsite. The blocks, in conjunction with tongue-and-groove fixtures cast integrally with the pipe, position and join adjacent sections. After the sections are tied-bolted together, their alignment fixtures are concreted. The \$2.2 million twin duct is part of a sewage treatment plant under construction for the City of Vienna, Austria. (Sandoski-FIRL)  
W76-08012

**WATER FLOW BINDING, TRY RELINING,**  
Los Angeles Memorial Coliseum and Sports Arena, Calif.

For primary bibliographic entry see Field 5F.  
W76-08013

**A NEW TYPE OF PLASTIC GROUND PIPE,**  
For primary bibliographic entry see Field 8G.  
W76-08014

**EXTENSION OF THE TORSHAVN BREAKWATERS,**

E. Pihl & Son AS, Copenhagen, Denmark.

S. Langvad, and T. Sorensen.

Proceedings, The Institution of Civil Engineers, Part I, Design and Construction, Vol. 56, p 127-142, May 1974. 11 fig.

Descriptors: \*Harbors, \*Breakwaters, \*Design criteria, \*Storms, \*Construction, Damages, Waves(Water), Atlantic ocean, Caissons.

Identifiers: \*Faroe islands, North Sea, Model tests, Reconstruction.

The port of Torshavn, the most important town of the Faroe islands, is a natural port, sheltered from waves from all directions except the south east. From this direction, waves may penetrate directly from the North Sea into the port. Effective sheltering works were not constructed until recently because such works would have had to be constructed in water depths of up to 23 metres. From 1957 to 1968, an extension of the existing breakwaters was designed and investigated by model tests regarding lay-out and type of structure to be adopted. Construction was completed in 1973. The structure adopted was essentially a rubble mound breakwater provided with concrete caissons on the harbor side to allow berthing of large ships along the breakwater. During construction, a severe south-easterly gale caused extensive damage to the works. This event gave rise to a critical review of the design criteria adopted for the structure, based on a detailed analysis of the nature and causes of the damage. This paper describes the main principles of the breakwater design and the investigations upon which the design criteria were based. The method of construction and the storm damage are also described, as well as the review of design criteria following experience of the storm damage. (Bell-Cornell)  
W76-08071

**EXPLICIT EQUATIONS FOR PIPE-FLOW PROBLEMS,**  
Roorkee University, Roorkee (U.P.), India.  
For primary bibliographic entry see Field 8B.  
W76-08084

### 8B. Hydraulics

**GRAYS HARBOR ESTUARY, WASHINGTON: REPORT 5, MAINTENANCE STUDIES OF 35-FT-DEEP (MSL) NAVIGATION CHANNEL; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

N. J. Brodgon, Jr.

Available from the National Technical Information Service, Springfield, Va 22161, as AD-017 561, \$7.75 in paper copy, \$2.25 in microfiche. Technical Report H-72-2, October 1975, 206 p, 26 tab, 20 photo, 96 pl.

Descriptors: \*Channel improvement, \*Estuaries, \*Hydraulic models, Shoals, Salinity, \*Model studies, \*Washington.

Identifiers: Dredged material, \*Grays Harbor(Wash), Navigation channels, Current velocity, \*Fixed-bed models.

The existing, comprehensive fixed-bed model of the Grays Harbor estuary was used to determine the effectiveness of three proposed dredged material areas in the estuary entrance in retaining material deposited from a hopper dredge; the effects of three proposed Sand Island Shoal Channel realignment plans on channel shoaling, current velocities, and salinities; the effects of eight proposed confined dredged material disposal islands on channel shoaling; and the effects of six channel improvement plans (training dike, groin fields, and turning/settling basin) on channel shoaling, current velocities, surface directions, salinities, and dye dispersion. Some important results of the model tests were: (1) hopper dredge disposal areas 1 and 3 were the most effective in retaining dredged material; (2) none of the three proposed Sand Island Shoal Channel realignment

## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

plans would cause any major changes in existing current velocities or salinities; (3) channel shoaling tests conducted with proposed dredged material disposal islands installed showed that islands 2 and 8A would result in increased shoaling rates or create adverse navigation conditions; (4) no adverse effects were evident from surface-current pattern direction taken for any of the 35-ft-deep channel improvement plans. (WES)  
W76-07454

**SUPERCritical FLOW AT OPEN-CHANNEL JUNCTIONS; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer District, Los Angeles, Calif.  
Report No. 2-100, July 1975. 161 p, 1 tab, 55 photo, 42 pl.

Descriptors: \*Hydraulic models, Flow, \*Channels, \*Supercritical flow, Turbulence, Waves(Water), \*Open channel flow, \*Junctions, \*Model studies.  
Identifiers: \*Confluences.

Hydraulic model tests were made to generalize and verify the hydraulic design of confluence structures. Model investigation of certain confluences showed unsatisfactory flow conditions involving considerable turbulence in the confluence structure and transverse waves in the channel downstream. Major changes in particular designs were effected. Various schemes were introduced in each case. Lengthening the transition downstream from divider wall and minimal angle of intersection of the two channels were found to be the most efficient solutions. (WES)  
W76-07455

**SHORE EFFECT MODEL, ATLANTIC GENERATING STATION; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
R. W. Whalin, J. H. Barwis, R. D. Carver, and D. D. Davidson.  
Technical Report H-75-16, November 1975. 177 p, 31 tab, 32 photo, 56 pl, 3 append, 23 ref.

Descriptors: \*Breakwaters, \*Hydraulic models, \*Nuclear power plants, \*Offshore platforms, \*Shores, \*Shore protection, Waves(Water), \*Model studies.  
Identifiers: \*Atlantic generating station.

A distorted-scale hydraulic model investigation was performed to determine the potential effect, if any, of a proposed offshore nuclear power plant on shoreline evolution. Model measurements of current patterns with and without the breakwater were directly compared and measurements of breaking wave characteristics (height, depth, and angle to shoreline) with and without the breakwater were used to calculate and compare longshore transport rates in the potentially affected areas. It was concluded that the proposed construction would have a negligible effect on future shoreline evolution. (WES)  
W76-07457

**RELIABILITY OF RUBBLE-MOUND BREAKWATER STABILITY MODELS,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
R. Y. Hudson.

Available from the National Technical Information Service, Springfield, Va., 22161, as AD-A011 266, \$4.00 in paper copy, \$2.25 in microfiche. Miscellaneous Paper H-75-5, June 1975. 42 p, 6 fig, 2 append, 25 ref.

Descriptors: \*Hydraulic models, \*Breakwaters, \*Waves(Water), Model studies, Stability.  
Identifiers: \*Rubble-mound breakwaters, \*Wave action.

Designing rubble-mound breakwaters to withstand the forces of wave action in such a way as to obtain safe and economical structures is difficult. It is necessary in many cases, therefore, to conduct scale-model investigations to determine the optimum design. The basis upon which rubble-mound stability models are designed, constructed, and operated is explained and information is provided from which the accuracy of such models can be appraised. Hydraulic scale models can be used to determine the stability of rubble-mound breakwaters, and the accuracy of the test results will fall within the limits required to design safe and economical prototype structures, if the model is designed and operated correctly and the test conditions are selected judiciously. (WES)  
W76-07459

**OUTLET WORKS FOR BELTZVILLE DAM, POHOPOCO CREEK, PENNSYLVANIA; PROTOTYPE TESTS,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
E. D. Hart, and C. A. Pugh.

Available from National Technical Information Service, Springfield, Va. 22161, as AD-A010-636. \$4.50 in paper copy \$2.25 in microfiche. Technical Report H-75-10, May 1975. 51 p, 14 fig, 4 tab, 14 pl, 7 ref, append.

Descriptors: \*Outlet works, \*Prototype tests, Flow, Dams, Hydrostatic pressure, Pressure, Air demand, \*Hydraulic design, Intake structures, Hydraulic models, Conduits, \*Pennsylvania.  
Identifiers: \*Beltzville Dam(Penn), \*Pohopoco Creek(Penn).

Prototype measurements made at Beltzville Dam were of special interest in that (a) the prototype is very similar in design to the model (which received extensive testing prior to prototype construction); (b) the long, straight conduit aids the development of a uniform gradient; and (c) a slugtype flow known as 'burping' had been experienced at the project. Tests were conducted in the 7-ft-diam flood-control conduit and in the water-quality control intake structure. Measurements included: (a) hydrostatic pressures at seven piezometer pairs along the conduit, (b) pressure fluctuations in the conduit transition zone and downstream of the water-quality control gate, (c) air demand downstream of the control gates, (d) impact pressures in the water intake tower, (e) pressures in the converging vertical bend at the base of the wet well, and (f) high-speed motion pictures of the slug flow at the outlet portal. Good agreement was found between the comparable model and prototype data. (WES)  
W76-07461

**WESTPORT SMALL-BOAT BASIN REVISION STUDY; HYDRAULIC MODEL INVESTIGATION,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
J. N. Brogdon, Jr.

Available from National Technical Information Service, Springfield, Va. 22161, as AD-A018 422, \$6.75 in paper copy, \$2.25 in microfiche. Miscellaneous Paper H-75-8, November 1975. 167 p, 1 fig, 20 tab, 75 photo, 70 pl.

Descriptors: \*Hydraulic models, \*Tides, \*Washington, Harbors, Model studies.  
Identifiers: \*Flushing, Small boat basins, \*Grays Harbor(Wash), Westport(Wash).

An existing comprehensive fixed-bed model of the Grays Harbor Estuary was used to evaluate the flushing characteristics of three proposed revision plans to the existing Westport Small-Boat Basin. Model tests were conducted to determine current velocities in the two exists for basin conditions and plan 1, surface current patterns for base conditions and plans 1 and 3, and flushing characteristics for base conditions and plans 1-3. Each

plan improved flushing with plan 3 being the most effective. (WES)  
W76-07462

**PHYSICAL HYDRAULIC MODELS: ASSESSMENT OF PREDICTIVE CAPABILITIES; REPORT 1, HYDRODYNAMICS OF THE DELAWARE RIVER ESTUARY MODEL,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. V. Letter, Jr., and W. H. McAnally, Jr.  
Available from National Technical Information Service, Springfield, Va. 22161, as AD-012 766, \$6.00 in paper copy, \$2.25 in microfiche. Research Report H-75-3, June 1975 122p, 7 fig, 12 tab, 61 pl, 5 ref.

Descriptors: \*Estuaries, \*Hydraulic models, Tides, Pennsylvania, New Jersey.  
Identifiers: \*Delaware Estuary, Navigation channels, \*Tidal currents.

The purpose is to define the reliability with which results of tests conducted in physical model of the Delaware River Estuary can be used to predict the effects of modifications to the estuary. The Delaware River model at the Waterways Experiment Station was used to conduct tests to predict the effects of the navigation channel enlargement between Philadelphia and Trenton, and the results of the tests are compared with subsequent prototype data to determine the accuracy of the model predictions. Two prototype surveys provided tidal and current velocity data for the high- and low-freshwater discharge conditions in 1972, and the results of model tests duplicating those conditions were used to determine accuracy of model predictions. Tidal propagation, as measured by the range, phasing, and energy dissipation rates, was predicted as accurately as the model had been originally verified. The same is true of current velocities. It is concluded that, for projects involving estuarine modifications up to the scale of navigation channel enlargement, the physical hydraulic model, when carefully verified, can accurately predict the effects of the project on the estuarine system. (WES)  
W76-07463

**EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE ALEUTIAN TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.

J. R. Houston, R. W. Whalin, A. W. Garcia, and H. L. Butler.  
Available from National Technical Information Service, Springfield, Va. 22161, as AD-A014 145, \$4.50 in paper copy, \$2.25 in microfiche. Research Report H-75-4, July 1975. 48 p, 28 fig, 22 ref, 1 app.

Descriptors: \*Earthquakes, \*Mathematical models, \*Pacific coast region, \*Tsunamis, \*Alaska, Coasts.  
Identifiers: \*Aleutian Trench(Alaska).

An investigation was undertaken to ascertain the effect of the orientation and location of elliptically shaped tsunamigenic ground displacements of earthquakes along the Aleutian Trench on resulting tsunami amplitude along the Pacific coast of the continental United States. The Aleutian Trench was partitioned into 12 segments and a hypothetical ground displacement was centered in each segment. A numerical model was used to propagate the tsunami generated by an uplift to the Pacific coast of the continental United States. An analytical solution of the governing equations of motion was used to propagate the tsunami from the grid points of the numerical grid closest to land to a common water depth of 600 ft so that there would be a standard depth to facilitate comparisons. Contour plots of water-surface wave

elevation 3 hr after generation of the tsunamis readily depict the directional patterns of the wave radiated by the ground displacements. Plots were made of the amplitude of the leading wave of the tsunami as a function of distance along the Pacific coast (for observation points from the Mexican border to Canada). These plots allow an evaluation of the relative vulnerability of an area along the west coast of the United States to tsunami inundation as a function of the location of a tsunamigenic earthquake along the Aleutian Trench. (WES)

W76-07464

**SCALE EFFECTS IN RUBBLE-MOUND BREAK-WATER STABILITY MODELS CAUSED BY VARIATIONS IN THE SPECIFIC GRAVITY OF THE ARMOR UNITS AND UNDERLAYER STONES,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

R. Y. Hudson.

Available from National Technical Information Service, Springfield, Va. 22161, as AD-012 069, \$3.50 in paper copy, \$2.25 in microfiche. Miscellaneous Paper H-75-4, May 1975. 18 p, 3 fig, 6 ref, append.

Descriptors: \*Rocks, \*Breakwaters, \*Specific gravity, \*Stability, Model studies, Hydraulic models.

Identifiers: \*Armor units(Hydraulics), \*Rubble-mound breakwaters.

The analytical bases for obtaining dynamic similarity between model and prototype for rubble-mound stability studies were reviewed, and the results of available small-scale tests were analyzed to determine whether variations in the specific gravity of the armor units in the model, compared with the corresponding specific gravity of the prototype units, resulted in undesirable scale effects. Some of the main conclusions were: (a) Considering the Kyland and Sødejord data, the stability number, as defined in this report, varies with the specific gravity of the armor units relative to the water in which the structure is situated; (b) considering the Waterways Experiment Station data and the relatively small variations in the specific gravities of the armor units, model to prototype, that have occurred in the model studies conducted to determine the design of the proposed Public Service Electric and Gas Company of New Jersey breakwaters, the scale effects due to the specific gravity ratio are negligible, and (c) the conclusions (a) and (b) also apply to the underlayer and core materials when they are exposed to wave action by damage to the armor-unit cover layer. (WES)

W76-07465

**MASONBORO INLET, NORTH CAROLINA, MOVABLE-BED HYDRAULIC MODEL STUDY, EFFECTS OF TEMPERATURE AND EXPERIMENTAL PROCEDURES,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

R. A. Sager, and N. W. Hollyfield.

Miscellaneous Paper H-75-10, December 1975. 117 p, 12 fig, 3 tab, 34 pl, 11 ref, 3 append.

Descriptors: \*Hydraulic models, \*Water temperature, Waves(Water), \*Model studies, \*North Carolina.

Identifiers: \*Masonboro Inlet(NC), \*Movable-bed models.

The study was conducted to determine the effects of water temperature on the results from a movable-bed model study of Masonboro Inlet, North Carolina, with a secondary objective to determine the effects of experimental procedures on the model results. The erratic reproduction of short-period waves near the beach and inlet was found to be the most probable source of experimental error. Other experimental errors discussed include

the influence of initial molding of the movable bed, method of simulation of littoral transport approaching the inlet test sections, and bed sounding procedure. The study did not define temperature effects on movable-bed model results; however, no evidence was found to indicate that temperature adversely affected the results of the Masonboro Inlet model tests within the range of temperatures investigated (50 to 78 deg.). A general course of action to resolve the question of temperature effects is recommended. The study consisted of three pairs of tests. Two pairs of tests were conducted with different water temperatures; the third pair was conducted with the same water temperature and was thus a "control" series. Results of the hydrographic surveys, scour and fill maps, and beach profiles are presented in the Appendices. (WES)

W76-07466

**MOBILE BAY MODEL STUDY: EFFECTS OF PROPOSED THEODORE SHIP CHANNEL AND DISPOSAL AREAS ON TIDES, CURRENTS, SALINITIES, AND DYE DISPERSION,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

R. J. Lawing, R. A. Boland, and W. H. Bobb.

Available from the National Technical Information Service, Springfield, Va 22161, as AD-A015 475, \$8.00 in paper copy, \$2.25 in microfiche. Report 1, September 1975. 418 p, 15 fig, 12 tab, 30 photo, 297 pl, 4 append. Technical Report H-75-13. (App. C and D bound in separate volume).

Descriptors: \*Dye dispersion, Environmental effects, \*Hydraulic models, Salinity, Tides, Currents(Water), \*Alabama.

Identifiers: Dredged material, \*Mobile Bay(Ala), Theodore ship channel(Ala), \*Salinity regimens, \*Tidal currents.

The Mobile Bay model was a fixed-bed model reproducing about 268 square miles of the Gulf of Mexico from Pine Beach on the east to about the west end of Dauphin Island, all of Mobile and Bon Secour Bays, a portion of Mississippi Sound, and the Mobile and Tensaw Rivers and adjacent marshes to the junction of the two rivers at Mt. Vernon, some 40 miles upstream from Mobile. The model was equipped with the necessary appurtenances for accurate reproduction and measurement of tides, tidal currents, salinities, freshwater inflows, density effects, and other important prototype phenomena. The purpose of the model study was to determine the impact of a proposed access channel, referred to as Theodore Ship Channel, and the necessary islands designed to hold the initial construction material and subsequent maintenance dredging on salinities and flow patterns with special interest centered on the oyster industry at the lower end of Mobile Bay. The agreements attained between similar model and prototype values were considered satisfactory. The test results consist of comparable measurements of tide heights, current velocity, salinities, surface current patterns, and dye dispersion patterns for existing and proposed conditions. (WES)

W76-07467

**EXPANSION OF PORT HUENEME, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

L. G. Crosby, D. L. Durham, and C. E. Chatham, Jr.

Available from the National Technical Information Service, Springfield, Va 22161, as AD-A010 324, \$5.50 in paper copy, \$2.25 in microfiche. Technical Report H-75-8, April 1975. 111 p, 1 fig, 6 tab, 27 photo, 38 pl, append, 12 ref.

Descriptors: \*Harbors, \*Hydraulic models, \*Waves(Water), Mathematical models, \*Model studies, California.

Identifiers: \*Port Hueneme(Cal), \*Water wave generation.

A 1:100-scale model of Port Hueneme Harbor, California, and sufficient offshore area of the Pacific Ocean to permit generation of the required long-period test waves was used to investigate the effects of a proposed expansion of the harbor on mooring conditions and harbor oscillations. The proposed expansion consisted of a 710- by 450-ft extension of the east basin in a northeasterly direction. A 56-ft long wave machine and electrical wave-height measuring and recording apparatus were utilized in model operation. In addition, results obtained on two mathematical models of harbor oscillation were compared with the hydraulic model test results. It was concluded that the expansion of the east basin will not adversely affect mooring and navigation conditions in most areas of the harbor. Also the mathematical models give a reasonable good comparison with the hydraulic model within certain limitations, however further research is necessary to develop the full potential of numerical harbor oscillation models. (WES)

W76-07468

**FOURMILE RUN LOCAL FLOOD-CONTROL PROJECT, ALEXANDRIA AND ARLINGTON COUNTY, VIRGINIA; HYDRAULIC MODEL INVESTIGATION,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

N. R. Oswalt, J. F. George, and G. A. Pickering.

Available from the National Technical Information Service, Springfield, Va 22161, as AD-A019 826, \$4.50 in paper copy, \$2.25 in microfiche. Technical Report H-75-19, December 1975. 60 p, 11 fig, 1 tab, 8 photo, 20 pl.

Descriptors: \*Bank protection, \*Channel improvement, \*Flood control, \*Hydraulic models, Open channel flow, Channels, Energy dissipation, Flow control, \*Virginia.

Identifiers: Alexandria(Va), Arlington County(Va), \*Fourmile Run(Va).

The proposed plan for containing flood flows in the Fourmile Run Channel near Alexandria, Va. consists of eliminating existing constrictions in the channel, excavating and widening the channel, providing adequate bank-slope protection, and constructing energy dissipators, grade control structures, and flow dividers. The investigation was conducted with a 1:30-scale model that reproduced approximately 5700 ft of the Fourmile Run channel and 400 ft of the Long Branch tributary. Flow conditions through the hydraulic structures of the original design protection plan from the I-95 Bridge to just downstream of West Glebe Road Bridge were unsatisfactory for design discharges. With design discharges in the improved natural soft-bottom channel, surface waves between I-95 and West Glebe Road Bridge caused failure of the riprap on the bank slopes. Discharges exceeding 8000 cfs overtopped portions of the left slope between West Glebe Road Bridge and Long Branch and both bank slopes downstream from Mount Vernon Avenue Bridge. The proposed drop structure in Long Branch will lower the water-surface elevation to coincide with that in Fourmile Run and will reduce erosive velocities in the channel. (WES)

W76-07469

**LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 17-3, LONGSHORE WAVE ENERGY ANALYSES,**

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

D. G. Outlaw, and D. L. Durham.

Available from the National Technical Information Service, Springfield, Va 22161, as AD-A016 900, \$7.50 in paper copy, \$2.25 in microfiche. Technical Report H-74-6, September 1975 176 p, 8 fig, 112 tab, 20 pl, 3 append, 19 ref.

Descriptors: \*Lake Erie, \*Airports, Waves(Water), Shore protection, Shores, \*Ohio.

## Field 8—ENGINEERING WORKS

### Group 8B—Hydraulics

Identifiers: \*Longshore waves, \*Wave heights, \*Cleveland(Ohio).

Monthly and annual direction distribution tables for significant wave heights and significant periods have been prepared for the west-southwest through the north to the northeast in 22.5-deg segments using hindcast data for Cleveland, Ohio, developed by A.H. Glenn and Associates of New Orleans, Louisiana. The significant height-significant period tables in the hindcast were used to distribute linearly the significant period over the monthly and annual percentages of occurrence of significant wave heights from each of specified directions. Calculated monthly and annual net longshore wave energy is estimated for 15 locations along the Lake Erie shoreline near Cleveland. The longshore energy is variable along the shoreline, but a general eastwardly net longshore direction for the wave energy is indicated by the longshore wave energy data near Cleveland. Comparison of estimated and observed noncohesive longshore transport at two sites near Cleveland with results of this study indicates that shoreline composition, geometry, and protective structures have a significant effect on longshore transport near Cleveland. An estimate for the average annual total longshore energy is given. (WES) W76-07470

#### WAVE AND CURRENT CONDITIONS FOR VARIOUS MODIFICATIONS OF KEWALO BASIN, HONOLULU, OAHU, HAWAII, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

M. L. Giles.

Available from the National Technical Information Service, Springfield, Va. 22161, as AD A016 149, \$6.00 in paper copy, \$2.25 in microfiche. Technical Report H-75-15, September 1975. 128 p, 3 fig, 21 tab, 68 photo, 9 pl, 9 ref.

Descriptors: \*Hydraulic models, \*Currents(Water), \*Waves(Water), Channels, Jetties, Shoals, \*Hawaii.  
Identifiers: \*Water wave generation, \*Kewalo Basin(Hawaii), Wave absorbers.

A 1:75-scale undistorted hydraulic model of Kewalo Basin, Oahu, Hawaii, and sufficient offshore area to permit generation of the required test waves was used to develop and test several plans of improvement proposed to eliminate: (a) cross-currents in the entrance channel, (b) the presence of peaking and breaking waves in the entrance channel, and (c) undesirable wave action in the basin. Improvement plans consisted of (a) a proposed wave absorber along the channel sides, (b) various jetty plans, and (c) removal of the channel shoal. Some conclusions of the tests were: (a) Strong wave-induced crosscurrents entered the existing harbor channel for several hundred feet seaward of the existing jetty, (for some wave conditions, crosscurrents entered both sides of the channel and an eddy was formed); (b) peaking and breaking waves occurred in the existing channel for incident wave heights of 8 ft or greater, (c) wave heights up to 3.4 ft were measured in the existing basin, but piers in the basin generally prevented the formation of well-developed standing waves, (d) addition of a wave absorber along the sides of the entrance channel was the most effective improvement plan in reducing wave heights in the basin, and (e) removal of the channel shoal tended to slightly increase basin wave heights by allowing more energy to enter the harbor. (WES) W76-07471

#### NAVIGATION CONDITIONS AT UNIONTOWN LOCKS AND DAM, OHIO RIVER; HYDRAULIC MODEL INVESTIGATION.

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

L. J. Shows, and J. J. Franco.

Available from National Technical Information Service, Springfield, Va. 22161 as AD 010 639, \$5.50 in paper copy, \$2.25 in microfiche. Technical Report H-75-9, May 1975. 115 p, 16 fig, 22 tab, 7 photo, 29 pl.

Descriptors: \*Hydraulic models, \*Locks, \*Dams, \*Ohio River, \*Model studies, Kentucky, Illinois, Indiana.

Identifiers: Uniontown Locks and Dam(Ohio River), Navigation conditions, Wabash Island(Kentucky).

As part of the program for the modernization of navigation facilities on the Ohio River, Uniontown Locks and Dam will replace some of the existing low-lift locks and dams and provide a navigable pool about 69.7 miles long to the Newburgh Locks and Dam. The model investigation was concerned with the study of the composition and configuration of the dam, arrangement of the locks and lock walls, and navigation conditions in the lock approaches. Some results of the investigation were: (a) Satisfactory navigation conditions could be developed with either the 10-gate or 12-gate spillway located in the main channel; (b) currents in the upper approach to the locks would be affected by the eddy forming in the scallop in the right bank; (c) ports would be required in the upper guard wall of the riverward lock to lessen the intensity of the crosscurrents near the end of the wall; (d) satisfactory navigation conditions could be provided with a third lock located either riverward or landward of the two adjacent locks; (e) during construction of the spillway, navigation conditions could be difficult and possibly hazardous with the first-stage cofferdam under certain flow conditions. (WES) W76-07472

#### LOS ANGELES AND LONG BEACH HARBORS MODEL STUDY; REPORT 5, TIDAL VERIFICATION AND BASE CIRCULATION TESTS, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

W. H. McAnalley, Jr.

Available from National Technical Information Service, Springfield, Va. 22161 as AD A016 904, \$7.50 in paper copy, \$2.25 in microfiche. Technical Report H-75-4, September 1975. 193 p, 8 fig, 4 tab, 97 pl, 1 append, 6 ref.

Descriptors: \*Model studies, \*Hydraulic models, \*Harbors, California, Tides.

Identifiers: \*Los Angeles Harbor(Calif), \*Long Beach Harbor(Calif), Tidal currents, Tidal inlets.

The objectives of the Los Angeles and Long Beach Harbors model studies are to investigate tidal circulation and basin oscillation characteristics of the existing harbors and to evaluate the impact of proposed harbor modifications upon these phenomena. A physical hydraulic model has been constructed which reproduces astronomical tides and tidal currents and is capable of reproducing wastewater discharges. The model has been verified to correctly reproduce tidal elevations, phases, current velocities, and net flows observed in the prototype. It is concluded that: (a) The model can be used to reliably predict the effect of proposed harbor modifications on tidal elevations and tidal circulation within the harbors, (b) Tidal circulation within the harbors is weak for existing conditions, (c) careful design and model tests of proposed modifications should ensure that the harbor's ability to maintain adequate water quality is not impaired, and (d) a net flow toward the west in Cerritos Channel and a net flow toward the east in the outer harbor are characteristic for spring range tidal conditions. For neap tidal conditions net flow computations were inconclusive. (WES) W76-07474

#### DESIGN OF JUBAIL HARBOR, SAUDI ARABIA, ROYAL SAUDI NAVAL EXPANSION

PROGRAM; HYDRAULIC MODEL INVESTIGATION, Army Engineer Waterways Experiment Station, Vicksburg, Miss.

M. L. Giles, and C. E. Chatham, Jr.

Technical Report H-76-2, January 1976. 195 p, 15 fig, 33 tab, 54 photo, 50 pl, 8 ref.

Descriptors: \*Harbors, \*Hydraulic models, \*Model studies, Breakwaters, Shore protection, Piers, \*Dredging, Asia.

Identifiers: \*Water wave generation, Causeways, \*Jubail Harbor(Saudi Arabia), Arabian Gulf.

A 1:120-scale (undistorted) hydraulic model of the proposed Jubail Harbor site and sufficient offshore area to permit generation of the required test waves was used to investigate the arrangement and design of the proposed offshore structures with respect to wave heights at critical locations within the harbor complex. The basic harbor consisted of an offshore island connected to shore by a causeway, north and east breakwaters to provide protection for the island and an ammunition pier connected to shore by a causeway. Variations to the basic configuration included: (a) Realigning the breakwaters, (b) varying the crown elevation of the breakwaters, (c) lengthening and shortening the breakwaters, (d) adding various inner breakwaters and revetted slopes, (e) relocating the island, (f) relocating the ammunition pier, (g) additional dredging, and (h) relocating the entire harbor complex to a more shoreward location. A 24.4-m-long wave generator and electrical wave-height measuring and recording apparatus were utilized in model operation. (WES) W76-07475

#### OUTLET WORKS FOR TAYLORSVILLE LAKE, SALT RIVER, KENTUCKY; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

M. S. Dorch.

Available from the National Technical Information Service, Springfield, Va. 22161 as AD-A014 974, \$4.50 in paper copy, \$2.25 in microfiche. Technical Report H-75-12, August 1975. 57 p, 7 fig, 5 tab, 5 photo, 16 pl.

Descriptors: \*Hydraulic models, \*Outlet works, \*Stilling basins, \*Conduits, Flow, Flood control, \*Kentucky.

Identifiers: \*Taylorsville Lake(Ky), \*Salt River(Ky).

Model investigation of the outlet works for Taylorsville Lake was concerned with verification and improvement of the hydraulic design of the intake structure, conduit, and stilling basin. The study was conducted in a 1:25 scale model of the outlet works which reproduced a portion of the approach area, the intake structure, the outlet conduit, the hydraulic-jump type stilling basin, and approximately 120 ft of exit channel. The proposed intake structure provided effective regulation of both flood-control and water-quality releases. Flow and pressure conditions were satisfactory for all expected operating schemes. Performance of the original design stilling basin was unacceptable as unstable hydraulic action in the basin resulted in poor energy dissipation. Eddy formation throughout the lower range of discharges was a difficult problem to overcome because of the relatively low elevation of the outlet portal invert with respect to the tailwater elevation. Single or uneven gate operation produced unbalanced flow in the stilling basin; however, the eddies were not as severe as in the original design. (WES) W76-07476

#### DESIGN OF ENTRANCE CHANNEL IMPROVEMENTS FOR LUDINGTON HARBOR, MICHIGAN; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

## ENGINEERING WORKS—Field 8

### Hydraulic Machinery—Group 8C

L. G. Crosby, and C. E. Chatham, Jr.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-A016 148, \$5.00 in paper copy, \$2.25 in microfiche. Technical Report H-75-14, September 1975, 70 p, 2 fig, 12 tab, 29 photo, 7 pl, 6 ref.

Descriptors: \*Breakwaters, \*Channel improvement, Channels, \*Harbors, \*Hydraulic models, \*Model studies, \*Michigan, Lake Michigan.

Identifiers: Water wave generation, \*Wave absorbers, Ludington Harbor(Mich), \*Pere Marquette Lake(Mich).

A 1:100-scale model of Ludington Harbor, Michigan, including about two-thirds of Pere Marquette Lake and sufficient offshore area of Lake Michigan to permit generation of the required test waves, was used to investigate the effects of a proposed harbor entrance improvement plan on wave action in the harbor. Modifications to the basic plan which were tested consisted of several wave absorber designs along the inner entrance channel and raising the crown elevation of the north and south breakwaters to prevent wave overtopping. A 50-ft-long wave generator and a computer-controlled electrical wave height measuring and recording system were used in model operation. Some conclusions from model test results were: (a) The basic plan of improvement substantially increased wave heights in the entrance channel and in the vicinity of the car ferry docks; (b) the channel improvement plan did not significantly change existing current patterns; (c) inclusion of a rubble-mound breakwater by the small boat launching ramp in the outer basin was effective in reducing wave heights at the ramp; (d) an additional reduction in wave heights in the entrance channel and at the car ferry docks was accomplished by raising the crown elevation of the north and south breakwaters to prevent overtopping; and (e) raising the crown elevation of the breakwaters altered current patterns slightly. (WES)  
W76-07477

#### DESIGN OF AGANA SMALL-BOAT HARBOR, TERRITORY OF GUAM; HYDRAULIC MODEL INVESTIGATION,

Army Engineer Waterways Experiment Station, Vicksburg, Miss.

C. E. Chatham, Jr.

Available from the National Technical Information Service, Springfield, Va 22161 as AD-A005 146, \$6.00 in paper copy, \$2.25 in microfiche. Technical Report H-75-1, January 1975, 132 p, 5 fig, 7 tab, 12 photo, 83 pl, 6 ref.

Descriptors: \*Hydraulic models, \*Harbors, \*Waves(Water), Channels, Breakwaters, Pacific Ocean.

Identifiers: \*Agana Harbor(Guam), Small boat basins, \*Guam, Water wave generation, Wave absorbers, Wave action.

A 1:50-scale undistorted hydraulic model of Agana Harbor, the surrounding reef, and sufficient offshore area to permit generation of the required test waves was used to investigate the arrangement and design of proposed harbor improvements with respect to wave heights and wave-induced circulation conditions. The basic harbor configuration consisted of a new berthing basin, an access channel, a revetted landfill (including an area for a sewage treatment plant), east and west breakwaters, a wave absorber, and circulation channels. Some conclusions from the test results were: (a) No excessive wave heights were recorded in the existing harbor basins, but very confused wave and current patterns were present at the harbor entrance; (b) wave-induced circulation on the reef and in the existing entrance channel was good for all test conditions, but circulation in the existing harbor basins was generally poor; (c) addition of the beach to the west of the sewage treatment plant landfill improved circulation in this area, but for some wave conditions slack-

water areas were observed (similar to the beach west of the existing harbor basins); (d) removal of either the east or west breakwater (or both) resulted in strong crosscurrents in the entrance channel; (e) the box culverts proposed for the circulation channels reduced the effectiveness of these channels, indicating that a bridge would be the best means of access to the outer-fill areas. (WES)  
W76-07478

#### FORM, GENESIS, AND DEFORMATION OF CENTRAL CALIFORNIA WAVE-CUT PLATEFORMS,

Colorado Univ., Boulder. Dept. of Geological Sciences.

For primary bibliographic entry see Field 2L.  
W76-07552

#### NUMERICAL CALCULATION OF THE WAVE INTEGRALS IN THE LINEARIZED THEORY OF WATER WAVES,

Iowa Univ., Iowa City. Inst. of Hydraulic Research.

H. T. Shen, and C. Farrell.

IIHR Report No. 106, November 1975, 55 p, 4 fig, 2 tab, 19 ref, 2 append. ONR N00014-68-A-0196-0004, N00014-76-C-0012

Descriptors: \*Waves(Water), \*Hydrodynamics, \*Numerical analysis, \*Computer programs, Ships, Analytical techniques, Algorithms, Methodology, Resistance.

Identifiers: \*Wave integrals, Wave resistance, Submerged bodies.

A method for the numerical evaluation of the derivatives of the linearized velocity potential for three-dimensional flow past a unit source submerged in a uniform stream was presented together with a discussion of existing techniques. It was shown in particular that calculation of the double integral term in these functions can be efficiently accomplished in terms of a single integral with the integrand expressed in terms of the complex exponential integral, for which numerical computing techniques are available. Fortran programs prepared for evaluation of the first-order derivatives in connection with the calculation of second-order nonlinear contributions to the wave resistance of a body were appended. (Singh-ISWS)  
W76-07565

#### AQUIFER TESTS IN THE SUMMIT REACH OF THE PROPOSED CROSS-FLORIDA BARGE CANAL NEAR OCALA, FLORIDA,

Geological Survey, Tallahassee, Fla.

For primary bibliographic entry see Field 2F.  
W76-07599

#### SUMMARY OF RESEARCH IN ENGINEERING (COMPLETED AND IN PROGRESS), 1973-1974.

Louisiana State Univ., Baton Rouge. Div. of Engineering Research.

For primary bibliographic entry see Field 9A.  
W76-07787

#### COASTAL EROSION HAZARD IN THE UNITED STATES: A RESEARCH ASSESSMENT,

Rutgers - The State Univ., New Brunswick, N. J.

For primary bibliographic entry see Field 2L.  
W76-07788

#### SPILLWAY GATE MODIFICATION, BONNEVILLE DAM, COLUMBIA RIVER, OREGON AND WASHINGTON, HYDRAULIC MODEL INVESTIGATION,

Army Engineer Div. North Pacific, Bonneville, Oreg. Div. Hydraulic Lab.

T. D. Edmister, and P. M. Smith.

Available from the National Technical Information Service, Springfield, Va 22161, as ADA-011

397, \$4.00 in paper copy, \$2.25 in microfiche. Technical Report No. 136-1, May 1975, 43 p, 23 fig, 10 tab.

Descriptors: \*Model studies, \*Hydraulic models, \*Bonneville dam, \*Spillways, \*Hydraulic gates, \*Columbia River, Structures, Hydraulic structures, Dams, Spillway crests, Vibrations, Flow, Hydraulic design, Hydraulics, Oregon, Washington.

Model investigation verified that vertical vibration of the Bonneville spillway gates was caused by flow instability beneath the gate. When the gate bottom was submerged by tailwater and the gate was at certain openings, the line of flow control shifted back and forth between the gate seal near the center of the bottom and the upstream face of the gate. Pressure changes accompanying the control shifts created large changes in vertical force on the upstream half of the gate bottom. A bottom shape with a longer lip for better flow control was developed. The new shape was structurally feasible, usable in either set of existing gate slots without modification of embedded seal plates, and operable at all gate openings with negligible vertical vibration. Other shapes not usable with existing seal plates were developed but were considered less suitable. Model measurements indicated that the maximum discharge of 14 spillway bays with the maximum regulated pool (elev 75.5), individual gate hoists in place, and a powerhouse discharge of 132,000 cfs would be 693,000 cfs (river discharge 825,000 cfs). The pool energy grade line required to pass the spillway design discharge of 1,600,000 cfs was elev 87.0. The probable maximum flood of 2,100,000 cfs could pass through 18 bays of the spillway with a pool energy grade line of elev 104.3. With that condition, flow constriction by the spillway bridge would cause orifice flow through the bays. Average water surface at the spillway would be 0.5 ft below the top of the bridge parapet, but surging would raise the surface 3 ft above the top. (Sims-ISWS)  
W76-07792

#### EXPLICIT EQUATIONS FOR PIPE-FLOW PROBLEMS,

Roorkee University, Roorkee (U.P.), India.

P. K. Swamee, and A. K. Jain.

Journal of the Hydraulics Division, Proceedings of the American Society of Civil Engineers, Vol. 102, No. HY5, Proceedings paper No. 12146, p 657-664, May 1976, 2 fig, 10 ref.

Descriptors: \*Discharge(Water), \*Head losses, \*Hydraulics, \*Pipe flow, Friction, Darcy-Weisbach equation, Hydraulic properties, Pipes.

Direct solutions of pipe flow problems are not possible because of the implicit form of Colebrook-White equation which expresses the hydraulic resistance of commercial pipes. The three basic and major problems encountered in hydraulic engineering practice are the determination of pipe diameter, the discharge and the head loss. The solution of these problems on conventional lines involves many trials and tedious computations. Some research workers have proposed graphical solutions which have their own inherent limitations. Reported herein are explicit and accurate equations for pipe diameter and head loss and a closed form solution for the discharge through the pipe, based on Colebrook-White equation. These explicit equations can also be utilized with advantage in optimization studies of pipelines and water distribution systems. (Bell-Cornell)  
W76-08084

## Field 8—ENGINEERING WORKS

### Group 8C—Hydraulic Machinery

#### 8C. Hydraulic Machinery

**THE WATER AND TOTAL OPTIMIZATIONS OF WET AND DRY-WET COOLING TOWERS FOR ELECTRIC POWER PLANTS,**  
Iowa Univ., Iowa City. Inst. of Hydraulic Research.  
For primary bibliographic entry see Field 3E.  
W76-07674

**DEVELOPMENT OF DESIGN GUIDELINES FOR SHIPBOARD SEWAGE HOLDING TANKS.**  
For primary bibliographic entry see Field 5D.  
W76-07677

**DEVELOPMENT OF DESIGN GUIDELINES FOR SHORE-SIDE HOLDING TANKS.**  
For primary bibliographic entry see Field 5D.  
W76-07681

**GEOHERMAL ENERGY DEVELOPMENT.**  
For primary bibliographic entry see Field 6E.  
W76-07865

**DEVELOPMENT OF AN OPTIMUM DESIGN SIMULATION FOR SCREW PUMP PLANTS AND ITS APPLICATION FOR THE ICHIHARA MUNICIPAL DRAINAGE PUMP PLANT (SUKURYU PONPUJO SAITEKI SEKKEI SHIMURESHON NO KAIHATSU TO ICHIHARA-SHI ICHIHARA USUI H AISUI PONPUJO E NO TEKIVOREI).**  
T. Ito, I. Inoue, and R. Kozato.  
Gesudo Kyokai-shi, (Journal of Japan Sewage Works Association), Vol. 10, No. 108, p 24-40, May, 1973. 19 fig, 13 tab.

Descriptors: \*Pumping plants, \*Pumps, Storm runoff, Sewage, Model studies, Costs, Design, Construction, Drainage, Simulation.  
Identifiers: Screw pumps, Rainfall runoff, Rotation pumps.

Studies made for the Ichihara City, Japan, drainage pumping plant which is now in the design and construction stage, were based on a cost-down achieved by increasing the rotation speed of the pumps. The system is to be constructed on a general theory concept and adjusted to the actual conditions of the site with the plant being able to treat both storm runoff and sewage. Screw pumps are to be used on one level and the limit of lift head determined by the level of elevated water. The rain quantity, rain runoff, and sewage simulation systems will be constructed with the initial cost and the running cost calculated from the first year expenses. An optimum system designed by comparing the costs of various combinations of high rotation pumps and base pumps of various mouth sizes was determined to include nine high rotation pumps with 3000 mm diameter mouths and two combination pumps of high rotation and base pumps. (Seigle-FIRL)  
W76-08001!

**SEWER ALARM SYSTEM SAVES TAXPAYERS' DOLLARS,**  
Milford Dept. of Public Works, Conn.  
For primary bibliographic entry see Field 5D.  
W76-08030

#### 8D. Soil Mechanics

**DETECTION OF INCIPENT FAILURE IN EARTH DAMS,**  
Missouri Univ., Rolla.  
D. Rechtein, and L. W. Gardner.  
Available from the National Technical Information Service, Springfield, Va., 22161, as PB-252 942, \$3.50 in paper copy, \$2.25 in microfiche. Mis-

souri Water Resources Research Center, Columbia, Completion Report, March 26, 1976. 21 p, 9 fig, 6 ref. OWRT A-073-MO(1). 14-31-0001 - 4025 and 5025.

Descriptors: \*Earth dams, \*Vibrations, Earthquakes, \*Dam failure, Monitoring, Seasonal, \*Earthquake engineering, Seismic studies, Non-destructive tests, Structural stability.

A study was made of the dynamic properties of small dams by means of exciting the dam with a mechanical vibrator. The objective was to explore the reliability of the dynamic response parameters to detect incipient failure. Severe limitations within the mechanical vibrator limited the scope of this study to the investigation of the repeatability of the dynamic response to seasonal variations. The repeatability was extraordinary. It is believed, because of this repeatability, that incipient failure causing a change in the dynamic characteristics of the dam could be detected with repeated monitoring of the mechanical response of the structure.  
W76-07671

#### 8E. Rock Mechanics and Geology

**EFFECT OF SOURCE ORIENTATION AND LOCATION IN THE ALEUTIAN TRENCH ON TSUNAMI AMPLITUDE ALONG THE PACIFIC COAST OF THE CONTINENTAL UNITED STATES,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 8B.  
W76-07464

#### 8F. Concrete

**4000-FOOT OUTFALL HAS 640-FOOT DIFFUSER FOR OCEAN DISPERSEL.**  
For primary bibliographic entry see Field 5E.  
W76-08002

**ANOTHER WAY TO PUT A PIPE IN A RIVERBED,**  
For primary bibliographic entry see Field 8A.  
W76-08011

**PREFAB CASTING SYSTEM PACES SEWER JOB THROUGH WET SITE,**  
McGraw-Hill World News, Vienna (Austria).  
For primary bibliographic entry see Field 8A.  
W76-08012

#### 8G. Materials

**DETECTION OF INCIPENT FAILURE IN EARTH DAMS,**  
Missouri Univ., Rolla.  
For primary bibliographic entry see Field 8D.  
W76-07671

**A NEW TIGHT FIT - INSERTION OF A PLASTIC LINER IN A 42 INCH SEWER.**  
Public Works, Vol. 104, No. 6, p 98-99, June, 1973. 5 fig.

Descriptors: \*Plastic pipes, \*Sewers, Plastics, Joints(Connections), Concrete pipes, Construction equipment, Rehabilitation, Construction materials, Pipelines, Manholes, Texas, Sewerage. Identifiers: Houston(Tex), Polyethylene, Sewer repair.

Since September 1972, a major project in Houston, Texas, has been the insertion of a 36-inch plastic pipe in a 42-inch concrete sewer. This

was the first time lining a sewer of this size had been attempted and there were many problems, such as sewer cleaning during inclement weather. The pipe inserted is Mono-Line, furnished by Joseph T. Ryerson and Son, Incorporated. It is constructed of high-density polyethylene with an outer diameter of 35.433 inches and an inner diameter of 33.237 inches and weighs about 51.4 pounds per foot. It is shipped in 39-foot sections. Generally, the sections are joined above ground in the desired lengths, using a heater plate for welding. When sections were joined underground, joints were made with Dresser couplings and stabilized sand was used to surround the joints. A total of 2000 feet of concrete line was rehabilitated in the project. The first insertion amounted to 1750 feet. Special equipment was devised to permit pulling the pipe very slowly using a 7/8-inch cable and a 600 to one geared cable drum. Inverted nose cones were inserted in both ends so that assembled sections would be pulled in either direction as required. Jacks were then erected at manholes to reinforce the structures against the pulling force. The pipe was supported during the operation by a sling from a crane mounted on a tractor. Pipe ends were equipped with casters to ease sliding of the insertion sections in place. (Sandoski-FIRL)  
W76-07994

**PAPER DRAINS DEWATER EMBANKMENT.**  
For primary bibliographic entry see Field 8A.  
W76-07996

**LARGEST PVC FILTER INSTALLATION.**  
Public Works, Vol. 104, No. 6, p 106, June, 1973. 1 fig.

Descriptors: \*Waste water treatment, \*Trickling filters, Water pollution control, Municipal wastes, Industrial wastes, Filtration, Biological treatment. Identifiers: Stockton(Calif), Polyvinyl chloride, Filter media.

The largest known installation of polyvinyl chloride trickling filters for waste water treatment is to be completed by December at Stockton, California. Nearly 1.5 million cubic feet of B. F. Goodrich Koroseal Vinyl Core filter media will be required to fill three towers, each 22 feet high and 166 feet in diameter. The new towers will take the place of three rock media filters in an expansion and upgrading of the main municipal water pollution control plant at Stockton, which treats both municipal and industrial waste water. (Sandoski-FIRL)  
W76-07998

**A NEW TYPE OF PLASTIC GROUND PIPE,**  
Water and Wastes Engineering, Vol. 10, No. 7, p 13, July, 1973.

Descriptors: \*Plastic pipes, \*Construction materials, Water distribution(Applied), Polymers, Pipelines. Identifiers: Water transmission, Japan.

Seventeen hundred feet of 40-inch diameter nylon-reinforced plastic pipe that left a Japanese factory in a soft, coiled condition and was flown to the United States, was fed into a heating device carried behind a truck and emerged fully hardened and prepared for service. The pipe is adaptable for water transmission and certain water distribution systems, especially for longer pipe runs. Constructed of a special compound polymer and high tensile synthetic yarn, Takata H. F. pipe is said to be capable of being manufactured at strengths up to 300 psi. It is made and installed in essentially endless lengths. The pipe is economically competitive. (Sandoski-FIRL)  
W76-08014

## 8I. Fisheries Engineering

**FISHERIES AND ENERGY PRODUCTION: A SYMPOSIUM,**  
For primary bibliographic entry see Field 5C.  
W76-0747

**SIMULATING THE IMPACT OF THE ENTRAINMENT OF WINTER FLOUNDER LARVAE,**  
Rhode Island Univ., Kingston. Marine Experiment Station.  
K. W. Hess, M. P. Sissenwine, and S. B. Saila.  
In: *Fisheries and Energy Production: A Symposium*, p 1-29, 1975, 11 fig, 3 tab, 13 ref.

Descriptors: \*Entrainment, \*Larvae, \*Model studies, Nuclear energy, Population, Connecticut, Simulation analysis.  
Identifiers: Millstone Point (Conn).

Winter flounder larvae in the vicinity of Millstone Point, Conn. are transported by diffusion and by tidal action. Computer simulations were used to predict the numbers of larvae which could be entrained during the operation of a nuclear power station. A tidal hydrodynamic model simulated currents and water levels. A transport model simulated concentration of larvae. The integrated simulations of biological and hydrodynamic systems suggested that the potential impact of entrainment on the winter flounder of the Niantic River is less than a 1% reduction in year-class strength with a 6% reduction in population size after 35 years of plant operation. (See also W76-07487) (Chilton-ORNL)  
W76-07488

**THE MECHANICAL EFFECTS OF WATER FLOW ON FISH EGGS AND LARVAE,**  
Maryland Univ., Solomons, Md. Chesapeake Biological Lab.  
R. E. Ulanowicz.  
In: *Fisheries and Energy Production: A Symposium*, p 77-87, 1975, 1 fig, 1 tab, 21 ref.

Descriptors: \*Entrainment, \*Stress, \*Damages, \*Fish eggs, \*Larvae, Plankton, Shear stress, Abrasion, Pressure.  
Identifiers: Acceleration, Impaction.

While the impact of mechanical stresses on ichthyoplankton entrained in power plant cooling systems has long been considered negligible, this may not be true in nuclear power plants because of their greater water use. Three major physical forces which might cause mechanical damage to fish eggs and larvae are pressure change, acceleration and shear stress. Exhaustive research is required to define the ranges of pressure change, acceleration, impaction, shear, and abrasion which cause mortality of various entrained fishes and invertebrates. (See also W76-07487) (Chilton-ORNL)  
W76-07491

**ENTRAINMENT OF ORGANISMS AT POWER PLANTS, WITH EMPHASIS ON FISHES - AN OVERVIEW,**  
NUIS Corp., Pittsburgh, Pa. Cyrus Wm. Rice Div.  
For primary bibliographic entry see Field 5C.  
W76-07492

**LABORATORY AND FIELD TEMPERATURE PREFERENCE AND AVOIDANCE DATA OF FISH RELATED TO THE ESTABLISHMENT OF STANDARDS,**  
Virginia Polytechnic Inst. and State Univ., Blacksburg, Dept. of Biology.  
For primary bibliographic entry see Field 5C.  
W76-07494

**EXPERIMENTS RELATED TO DIRECTING ATLANTIC SALMON SMOLTS, SAIMO SALAR, AROUND HYDROELECTRIC TURBINES,**  
Fisheries and Marine Service, Halifax (Nova Scotia). Resource Development Branch.  
J. R. Semple, and C. L. McLeod.

In: *Fisheries and Energy Production: A Symposium*, p 141-165, 1975, 6 fig, 4 tab, 28 ref.

Descriptors: \*Engineering structures, \*Bypasses, \*Fish, Diversion structures, Smolt, \*Salmon, Turbines, Hydroelectric plants.

A fish by-pass and a floating-screen deflector were used to direct smolts around the hydroelectric turbines of a power station on the Tusket River in southwestern Nova Scotia. Deflection angle of floating-screen device was the most important factor for increasing smolt guidance efficiency. The most efficient deflector array for smolt guidance of those tested was one in which the deflector screens were operated to a depth of 2.44 m without a sounding lip and at an angle of 45 degrees to the direction of flow. Under these conditions an average bypass efficiency of 72.1% was achieved. (See also W76-07487) (Chilton-ORNL)  
W76-07495

**THE EFFECTS OF TWO ELECTRICAL BARRIERS ON THE ENTRAINMENT OF FISH AT A FRESHWATER NUCLEAR POWER PLANT,**  
Rhode Island Univ., Kingston. Marine Experiment Station.

M. A. Hyman, W. H. Mowbray, and S. B. Saila.  
In: *Fisheries and Energy Production: A Symposium*, p 205-237, 1975, 3 fig, 7 tab, 21 ref.

Descriptors: \*Entrainment, \*Barriers, \*Electrical equipment, Fish, Nuclear powerplants.  
Identifiers: Connecticut Yankee Atomic Power Plant.

Two electrical barriers designed to discourage the presence of fish from intakes at the Connecticut Yankee Atomic Power Plant at Hadam Neck, Conn. are described. Both systems statistically reduced the number of fish entrained. A study showed that the system offers a potential for selectivity. Based on seasonality, natural abundance or ecological importance, the system can be adjusted to minimize certain groups. With the installation of conduit electrode arrays in four bays, the impingement of fish greater than 15 cm of five species was reduced 68 to 82% over previous levels. (See also W76-07487) (Chilton-ORNL)  
W76-07497

**PRELIMINARY REPORT ON WATER AVAILABILITY IN THE LOWER SHIP CREEK BASIN, ANCHORAGE, ALASKA--WITH SPECIAL REFERENCE TO THE FISH HATCHERY ON FORT RICHARDSON AND A PROPOSED FISH-HATCHERY SITE NEAR THE ELMENDORF AIR FORCE BASE POWERPLANT,**  
Geological Survey, Anchorage, Alaska.  
G. W. Freethy.

Available from the National Technical Information Service, Springfield, Va 22161, as PB-251-517, \$4.00 printed copy; \$2.25 microfiche. Water-Resources Investigations 48-75, January 1976. 21 p, 12 fig, 16 ref.

Descriptors: \*Available water, \*Fish hatcheries, \*Alaska, Hydrologic data, Reviews, Surface waters, Groundwater, Hydrogeology, Aquifer characteristics, Evaluation.  
Identifiers: \*Lower Ship Creek basin (Alaska), \*Anchorage (Alaska).

The availability of surface water and shallow groundwater in the lower Ship Creek basin, Anchorage, Alaska, was examined using 28 years of streamflow records and well logs. Streamflow gains and losses were estimated from 23 seepage investigations made since May 1957. A contour map of the top of the principal confining stratum

and an isopach map of the saturated material were made in order to locate areas with the greatest potential for unconfined groundwater development. An adequate supply of water needed for further development of the Fort Richardson fish hatchery probably is available downstream from that site from unconfined groundwater sources. Unconfined groundwater upstream from that site probably would not fulfill the water requirements of the hatchery. At the proposed fish-hatchery site on Elmendorf Air Force Base, it probably is not possible to withdraw the required water either from a system of wells in the unconfined groundwater zone or from Ship Creek during periods of low flow. Two areas upstream from the site offer better potential for unconfined groundwater development. (Woodard-USGS)  
W76-07595

**INTENSIFIED FISH CULTURE COMBINING WATER RECONDITIONING WITH POLLUTION ABATEMENT,**

Kramer, Chin and Mayo, Seattle, Wash.  
For primary bibliographic entry see Field 5G.  
W76-07711

**REPRODUCTION OF THE BANDED KILLIFISH: FUNDULUS DIAPHANUS DIAPHANUS (LE SUEUR), (IN FRENCH),**  
Service Faune Auebec, St. Faustin. Station for Pisciculture.

For primary bibliographic entry see Field 2H.  
W76-07937

**GNAWING AT FISHING NETTING: A PROBLEM IN CAGE-RAISING OF HERBIVOROUS FISH,**  
Fisheries Technology Unit, Haifa (Israel).  
M. Ben-Yami.  
Aquaculture, 3(2), p 199-202, 1974.

Descriptors: Fish, \*Herbivores, \*Nets, Forage fish, Algae.  
Identifiers: Cages, Israel, Red Sea, Siganus-Rivulatus, \*Rabbitfish.

Rabbitfish (*Siganus rivulatus*) have been experimentally reared in the Gulf of Eilat (Red Sea, Israel). Rabbitfish fingerlings were grown in improvised floating cages. In early spring 1972, these cages were stocked with juvenile rabbitfish which were fed and kept under observation. Two months later holes appeared in the small-mesh netting, and that signs of twine deterioration appeared in many places. As a result, many fish escaped. Microscopic examinations were made. These showed that the twine of the netting after prolonged and uninterrupted exposure in the Gulf's water was covered with a thick growth of algae and that the damage to the netting was caused by cutting of some or all of the filaments in the twine. The herbivorous rabbitfish had been attracted to the algae covering the twine, and gnawed at both the algae and the twine.—Copyright 1975, Biological Abstracts, Inc.  
W76-07970

**OBSERVATIONS ON THE BREEDING AND GROWTH OF THE GIANT FRESHWATER PRAWN MACROBRACHIUM ROSENBERGII (DE MAN) IN THE LABORATORY,**  
Ministry of Agriculture, Fisheries and Food, Conway (Wales). Shellfish Culture Unit.  
J. F. Wickins, and T. W. Beard.  
Aquaculture, 3(2), p 159-174, 1974.

Descriptors: \*Breeding, \*Reproduction, Growth rates, \*Freshwater fish, \*Shrimp.  
Identifiers: Macrobrachium-Rosenbergii, \*Prawns.

Three male and 20 female *M. rosenbergii* were observed for 390 days. Mating occurred readily and eggs were incubated for 20 days. The mean number of larvae per brood was 24,000. Larger

## Field 8—ENGINEERING WORKS

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females had proportionately larger broods. Larvae from 7 broods were cultured to the post-larval stage. The increase in length of the adults at each molt was constant (arithmetical growth) and did not alter when ova were maturing in the ovary. Prawns achieved larger mean length increments after the environmental conditions were improved. The molting frequency was very variable and, with 1 exception, did not change proportionately with length or age of the prawns. Females grew from 115-205 mm and males from 145-230 mm total length. Three females spawned more than 4 times in successive intermolt periods, and one produced viable larvae 5 times in succession. Two of the males sired viable larvae 4 and 7 times respectively during 1 intermolt period.—Copyright 1975, Biological Abstracts, Inc.  
W76-07971

**A RECIRCULATION SYSTEM FOR EXPERIMENTAL AQUARIAS,**  
For primary bibliographic entry see Field 7B.  
W76-07972

**BIOLOGY OF THE CARP IN THE MIN-GECHAUR RESERVOIR, (IN RUSSIAN),**  
For primary bibliographic entry see Field 2H.  
W76-07987

**INFLUENCE OF WATER TEMPERATURE ON INCUBATION AND HATCHING IN CHONDROSTOMA NASUS (LINNAEUS 1758),**  
Ceskoslovenska Akademie Ved, Brno. Ustav pro Vyzkum Obratovcu.  
M. Penaz.  
Zool Listy. 23(1), p 53-59, 1974.

Descriptors: \*Water temperature, \*Incubation, \*Fish hatcheries, Fish eggs, \*Embryonic growth stage, Fish reproduction.  
Identifiers: \*Chondrostoma-Nasus.

The duration of incubation of eggs in C. nasus is dependent on both the mean water temperature during the whole incubation and on water temperature during hatching. At a constant water temperature of 10°C., the incubation lasts 23 days and 3 h on the average; at a constant water temperature of 15°C., 8 days and 4.5 h. Higher temperatures prevailing during hatching accelerate hatching considerably. The degree of development at which the embryos hatch depends on water temperature during incubation. At lower temperatures, more advanced and larger embryos will hatch. The optimum temperature regime for artificial propagation of C. nasus and possible causes of the disappearance of the species from stream sections whose temperature regime was affected by the erection of river dams are discussed.—Copyright 1975, Biological Abstracts, Inc.  
W76-08053

## 9. MANPOWER, GRANTS AND FACILITIES

### 9A. Education (Extramural)

**WATER PROBLEMS AND RESEARCH NEEDS FOR HAWAII: 1975,**  
Hawaii Univ., Honolulu. Water Resources Research Center.  
For primary bibliographic entry see Field 6B.  
W76-07584

**SUMMARY OF RESEARCH IN ENGINEERING (COMPLETED AND IN PROGRESS), 1973-1974.**  
Louisiana State Univ., Baton Rouge. Div. of Engineering Research.  
Engineering Research Bulletin No. 115, 1975. 40 p.

Descriptors: \*Research and development, \*Projects, \*Research facilities, \*Engineering, \*Louisiana, Chemical engineering, Civil engineering, Electrical engineering, Mechanical engineering, Nuclear engineering, Oil industry, Engineering personnel, Hydraulic engineering, Environmental engineering, Engineering education.

Engineering research projects at Louisiana State University were briefly summarized. Each summary included the sponsor of the project, personnel, objectives, and results. Project summaries were presented for work in these departments: (1) Chemical Engineering, (2) Civil Engineering, (3) Division of Engineering Research, (4) Electrical Engineering, (5) Engineering Science, (6) Mechanical, Aerospace and Industrial Engineering, (7) Nuclear Science, and (8) Petroleum Engineering. A partial list of bulletins, reports, and journal papers from these organizations was included. (Sims - ISWS)  
W76-07787

### 9C. Research Facilities

**SUMMARY OF RESEARCH IN ENGINEERING (COMPLETED AND IN PROGRESS), 1973-1974.**  
Louisiana State Univ., Baton Rouge. Div. of Engineering Research.  
For primary bibliographic entry see Field 9A.  
W76-07787

## 10. SCIENTIFIC AND TECHNICAL INFORMATION

### 10C. Secondary Publication And Distribution

**RIVER POINT DIRECTORY FOR THE MISSISSIPPI RIVER-GULF COAST INLAND WATERWAYS SYSTEM,**  
Army Engineer Waterways Experiment Station, Vicksburg, Miss.  
For primary bibliographic entry see Field 2L.  
W76-07458

**INTERNATIONAL FIELD YEAR FOR THE GREAT LAKES,**  
National Oceanic and Atmospheric Administration, Ann Arbor, Mich. Great Lakes Environmental Research Lab.  
For primary bibliographic entry see Field 02H.  
W76-07563

**ANNOTATED BIBLIOGRAPHY OF TEXAS WATER RESOURCES REPORTS OF THE TEXAS WATER DEVELOPMENT BOARD AND UNITED STATES GEOLOGICAL SURVEY THROUGH AUGUST 1974,**  
Geological Survey, Austin, Tex.  
C. D. Friebel, and H. A. Wolff.  
Texas Water Development Board, Austin, Report 199, February 1976. 156 p.

Descriptors: \*Bibliographies, \*Hydrologic data, \*Documentation, \*Abstracts, \*Texas, Information retrieval, Publications, Indexing, Reviews, Water resources, Surface waters, Groundwater, Water quality.

This bibliography includes reports, written by the Texas Water Development Board and the U.S. Geological Survey. The reports are related to the development of water resources in Texas. It brings up to date two earlier bibliographies, Texas Water Commission Circulars 63-04 and 64-02, and covers a period from 1888 through August 1974. Annotations are included for each publication unless the title is considered self-explanatory. (Woodard-USGS)  
W76-07605

## 10D. Specialized Information Center Services

**SELECTED BIBLIOGRAPHY ON OZONE DISINFECTION,**  
Canada Centre for Inland Waters, Burlington (Ontario); and Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.  
For primary bibliographic entry see Field 05D.  
W76-07683

**WATER DATA COLLECTION AND USE,**  
Department of the Environment, London (England). Water Data Unit.  
For primary bibliographic entry see Field 07C.  
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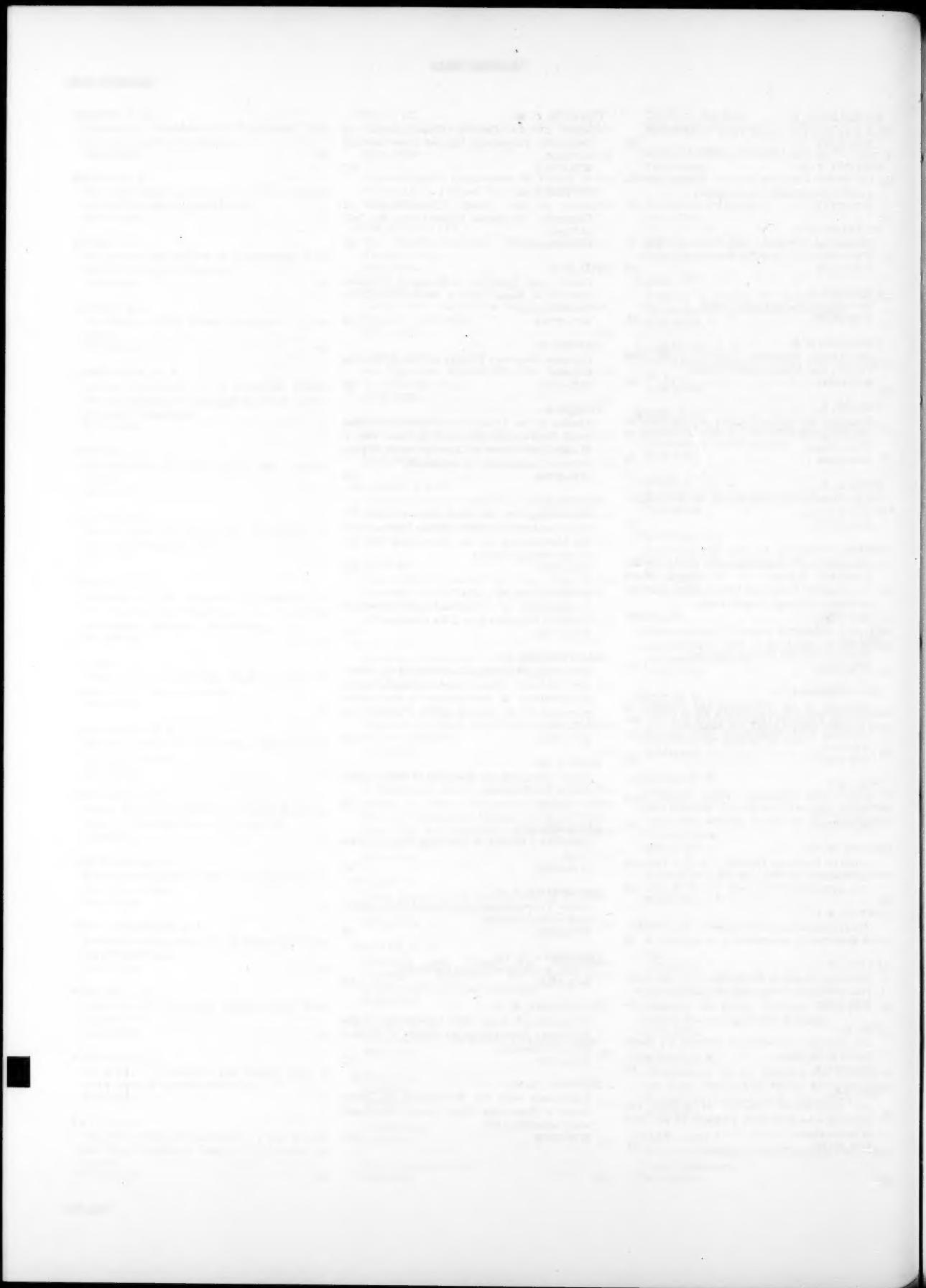
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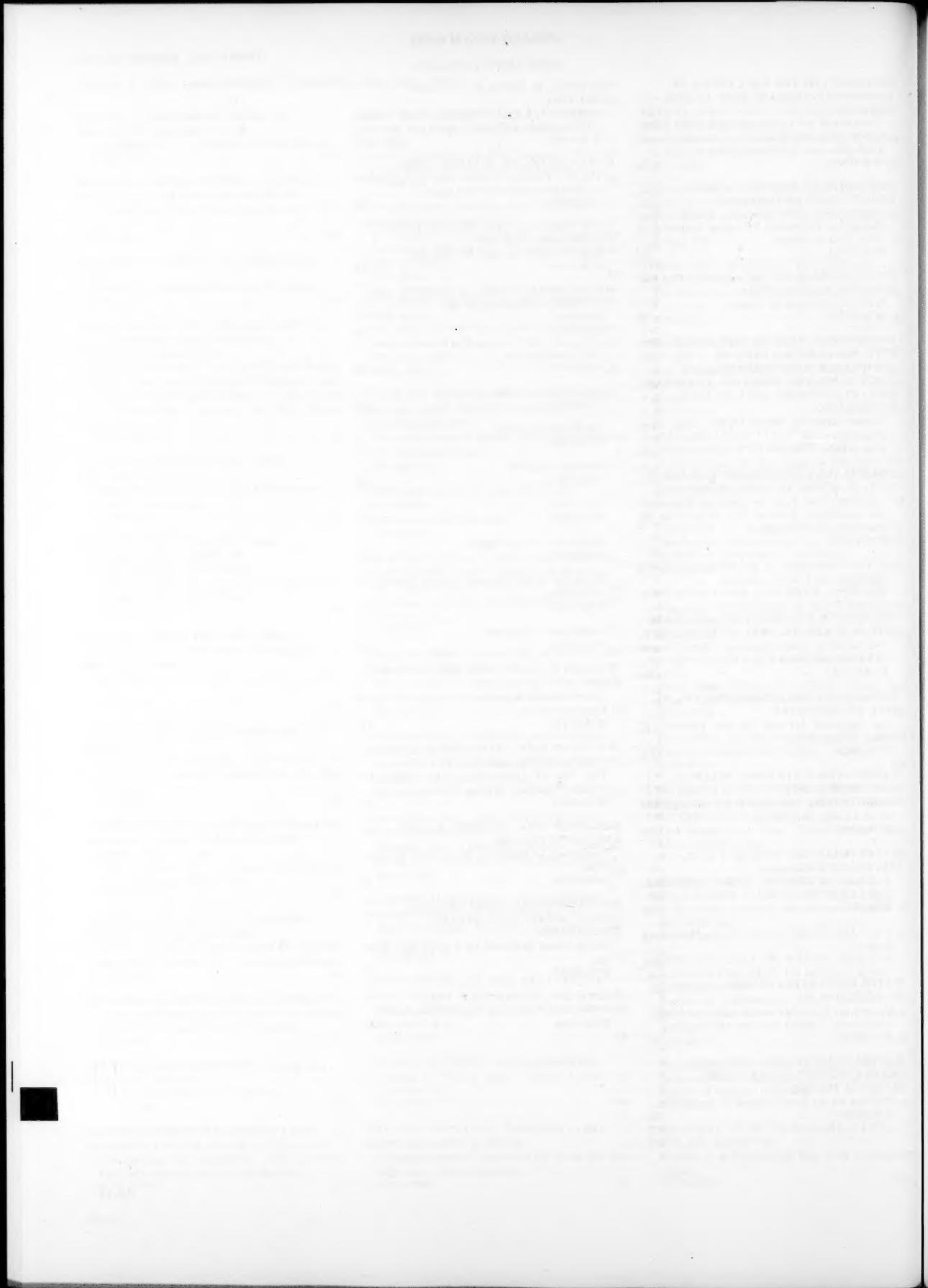
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